

Developer's Guide

Motorola g20 Developer's Kit

98-08901C67-O



REVISION HISTORY

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1.1 SCOPE OF THIS MANUAL

This manual introduces the g20 Developer's Kit, and describes the technical details required by the data terminal equipment user to successfully integrate the Motorola g20 cellular engine into an original equipment manufacturer (OEM) wireless host device. With the help of this manual, the user can utilize the Developer's Kit to conduct a full series of test and evaluation procedures on the g20, as well as perform application development.

We at Motorola want to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

You can reach us by email: GSM support-BSH015@email.mot.com.

1.2 WHO SHOULD USE THIS MANUAL

This manual is intended for all members of the DTE OEM integration team who will use the g20 Developer's Kit, including representatives from hardware, software and RF engineering disciplines.

1.3 DISCLAIMER

This guide provides advice and guidelines to developers. Responsibility regarding how the information is used lies entirely with the OEM. Statements indicating support provided by, or offered by, Motorola are subject to change at any time.

Motorola reserves the right to make any changes to this manual.

1.4 SAFETY

1.4.1 User Operation

Do not operate your telephone when a person is within eight inches (20 centimeters) of the antenna. A person or object within eight inches (20 centimeters) of the antenna could impair call quality and may cause the phone to operate at a higher power level than necessary, as well as expose that person to RF energy in excess of that established by the FCC RF Exposure Guidelines.

IMPORTANT: The telephone must be installed in a manner that provides a minimum separation distance of eight inches (20 centimeters) or more between the antenna and persons in order to satisfy FCC RF exposure requirements for mobile transmitting devices.

IMPORTANT: To comply with the FCC RF exposure limits and to satisfy the categorical exclusion requirements for mobile transmitters, the requirements described in the following section must be met.

1.4.2 Antenna Installation

- A minimum separation distance of eight inches (20 centimeters) must be maintained between the antenna and all persons.
- The effective radiated power of the transmitter must be less than 3.0 Watts ERP (4.9 Watts or 36.9 dBm EIRP). This requires that the combination of antenna gain and feed line loss not exceed 16 dBi.

1.5 APPLICABLE DOCUMENTS

g20 Cellular Engine Module Description: 9808901C66-O

g20 AT Commands: 9808901C68-O

1.6 TRADEMARKS

MOTOROLA and the Stylized M Logo are registered in the U.S. Patent and Trademark Office. All other product and service names are the property of their respective owners.

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1.7 TERMS AND ABBREVIATIONS

This section provides definitions for terms and abbreviations used in this document.

Table 1. Terms and Abbreviations

Acronym/Term	Definition/Description
ADC	Analog to Digital Converter
CMOS	Complementary Metal Oxide Semiconductor
CODEC	Coder-Decoder
DTE	Data Terminal Equipment (such as terminals, PCs and so on)
EME	Electromagnetic Energy Exposure
ESD	Electro-Static Discharge
EVB	Evaluation Board
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
IRQ	Interrupt Request
LED	Light-Emitting Diode
MIDI	Musical Instrument Digital Interface
MMCX	Mini Micro Coax
MMI	Man-Machine Interface
OEM	Original Equipment Manufacturer
PCM	Pulse Code Modulation
RF	Radio Frequency
SIM	Subscriber Identity Module
SPI	Serial Peripheral Interface
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus
UUT	Unit Under Test

1.8 HOW THIS MANUAL IS ORGANIZED

This manual contains the following chapters:

- **Chapter 1** contains this preface.
- **Chapter 2** introduces the g20 Developer's Kit and provides important safety instructions.
- **Chapter 3** describes the Developer Board and its components in detail, including connectors, jumpers, Dip switches and LED indicators. It also includes a set of setup procedures for first-time use.
- **Chapter 4** provides the mechanical requirements for mounting the g20 onto the Developer Board.
- **Chapter 5** provides contact information for Motorola Service Support and Customer Assistance.
- **Chapter 6** includes schematic diagrams of the g20 Developer's Kit as well as a complete parts list.

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INTRODUCTION

2.1 GENERAL DESCRIPTION

The g20 Developer's Kit is intended for evaluating the g20 module, as well as for developing and testing software applications for it.

The main component of the g20 Developer's Kit is the Developer Board, which is mounted in a chassis. The kit includes a cover for the Developer Board. The cover has openings on the top and side for the Developer Board's external connectors.



Figure 1. g20 Developer's Kit (top view, with cover)

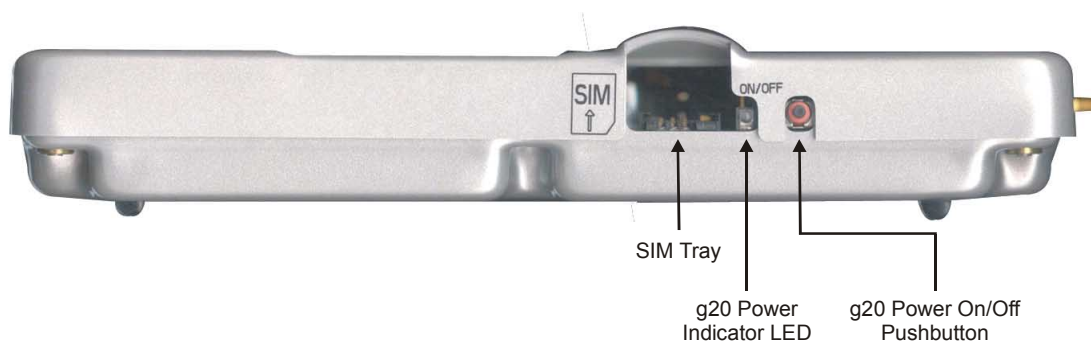


Figure 2. g20 Developer's Kit (front, with cover)

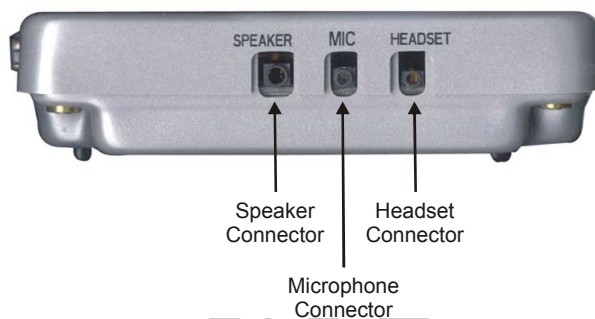


Figure 3. g20 Developer's Kit (left side, with cover)

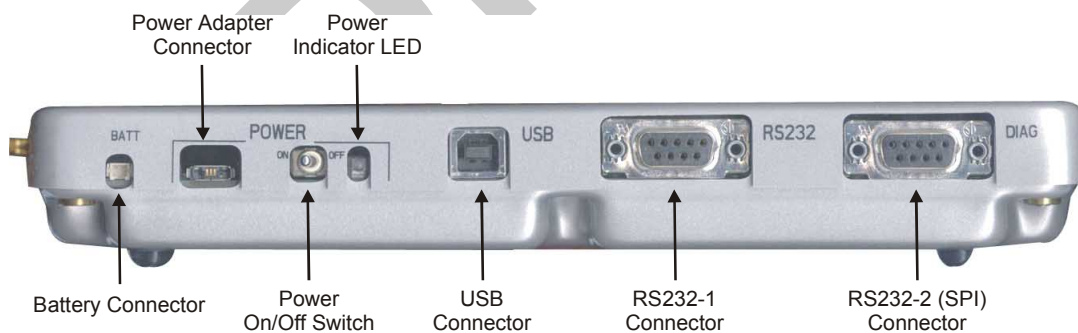


Figure 4. g20 Developer's Kit (rear, with cover)

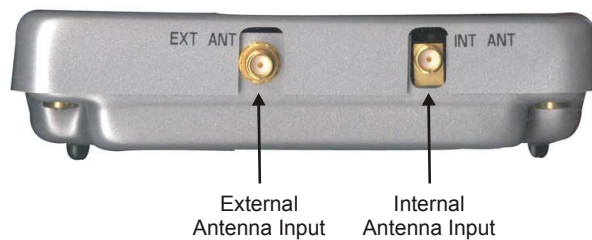


Figure 5. g20 Developer's Kit (right side, with cover)

2.2 PACKAGE CONTENTS

The g20 Developer's Kit includes the Developer Board, chassis and cover, as well as accessories that enable you to better utilize the board. The kit contains the following components:

Table 2. g20 Developer's Kit Package Contents

Part No.	Description	Quantity
FTN8121B	Developer Board	1
SPN4716B	Wall Mount Power Adapter	1
SYN7456A	European Plug for Adapter	1
SYN7455A	UK Plug for Adapter	1
8102316T02	Test SIM Card	1
SYN6962A	Mono Headset w/Detect	1
3087563V12	USB Cable	1
3087563V13	RS232 Cable	1
2987604U01	DC Power Input Mount — VCC	1
2987604U02	DC Power Input Mount — GND	1
0310907A03	M2/6mm Screw (for g20 fastening)	2
8509397T03	Antenna Stub	1
1587867V01	Developer Board Chassis	1
1587867V02	Developer Board Cover	1
3087568V01	RF cable between internal antenna and external connectors	1
3087568V02	RF cable with MMCX connector between g20 and external antenna connector	1
	Documentation and Software CD	1

Kit Number: F3030A

Figure 6 shows the g20 Developer's Kit, including the Developer Board (without cover) and the g20 and some accessories attached.

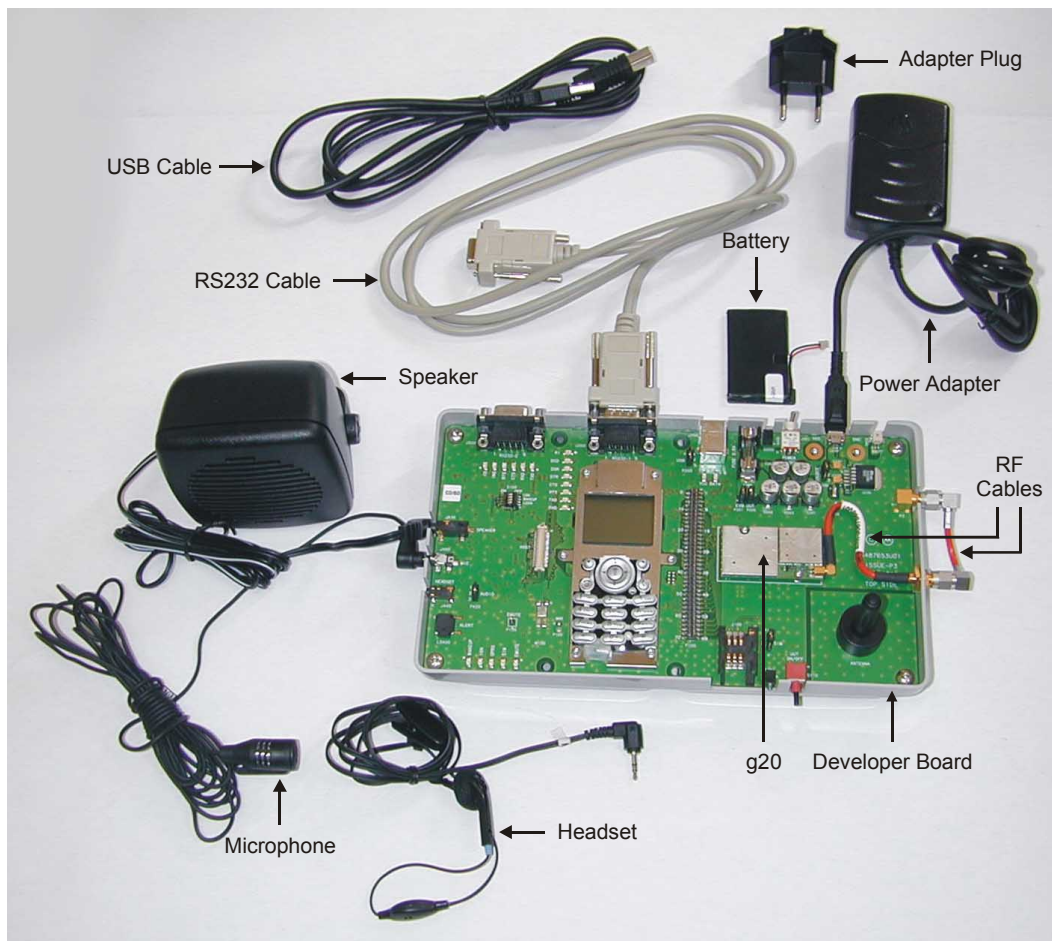


Figure 6. g20 Developer's Kit with Accessories and the g20

The Developer's Kit does not include a g20 device. A g20 must be obtained separately.

2.3 ACCESSORIES

Table 3 provides a list of accessories for the g20 Developer's Kit.

Table 3. Accessories Sold Separately

Part No.	Description
0189727L01	3.6V Lithium-Ion Battery
0187506V08	Host Interconnect Flex Cable
FSN5527A	Audio Speaker 8Ω
SYN5708D	Audio Microphone (Passive)

2.4 SAFETY PRECAUTIONS

Most Developer Board circuits are not shielded. Be sure to take appropriate precautionary measures in order to avoid ESD while handling the kit. ESD can damage the Developer Board and/or the g20 module attached to it.

DEVELOPER BOARD AND INTERFACES DESCRIPTION

3.1 HOW THIS CHAPTER IS ORGANIZED

This chapter contains the following sections:

- **Overview** provides an overview of the Developer Board.
- **Initial Setup** describes how to set up and prepare the Developer Board for first-time use.
- **Configuration** describes how to modify the default settings to control the operation of the Developer Board.
- **Components and Specifications** lists each connector, switch, jumper, Dip switch and LED and provides other details and specifications for the Developer Board.

3.2 OVERVIEW

The g20 Developer Board is designed to support the hardware and software development and validation of the g20 GSM/GPRS data module. The Developer Board provides a peripheral platform to operate the g20 as a standalone product, and to easily access the g20's 70-pin interface connector signals.

The Developer Board has the following functions:

- Serves as a mounting platform for the g20 module
- Supplies the g20 module with power
- Provides standard communication interfaces (USB and RS232) to the g20

3.2.1 Developer Board Features

The Developer Board provides the following features to facilitate software and hardware development:

- Easy access to the g20's 70-pin interface connector signals, through a large header connector and an external host connector
- AC, battery and DC power supplies for board operation
- LED indicators for critical signals
- Display and keypad for phone operation
- USB and RS232 serial interfaces
- Secondary RS232 interface using the SPI bus (for g20 debugging)
- Digital audio interface
- Analog audio interface for speaker, alert transducer, microphone and headset
- SIM card connector
- Switches and jumpers for controlling board operation

3.2.2 Developer Board Components

Figure 7 shows the Developer Board and its components:

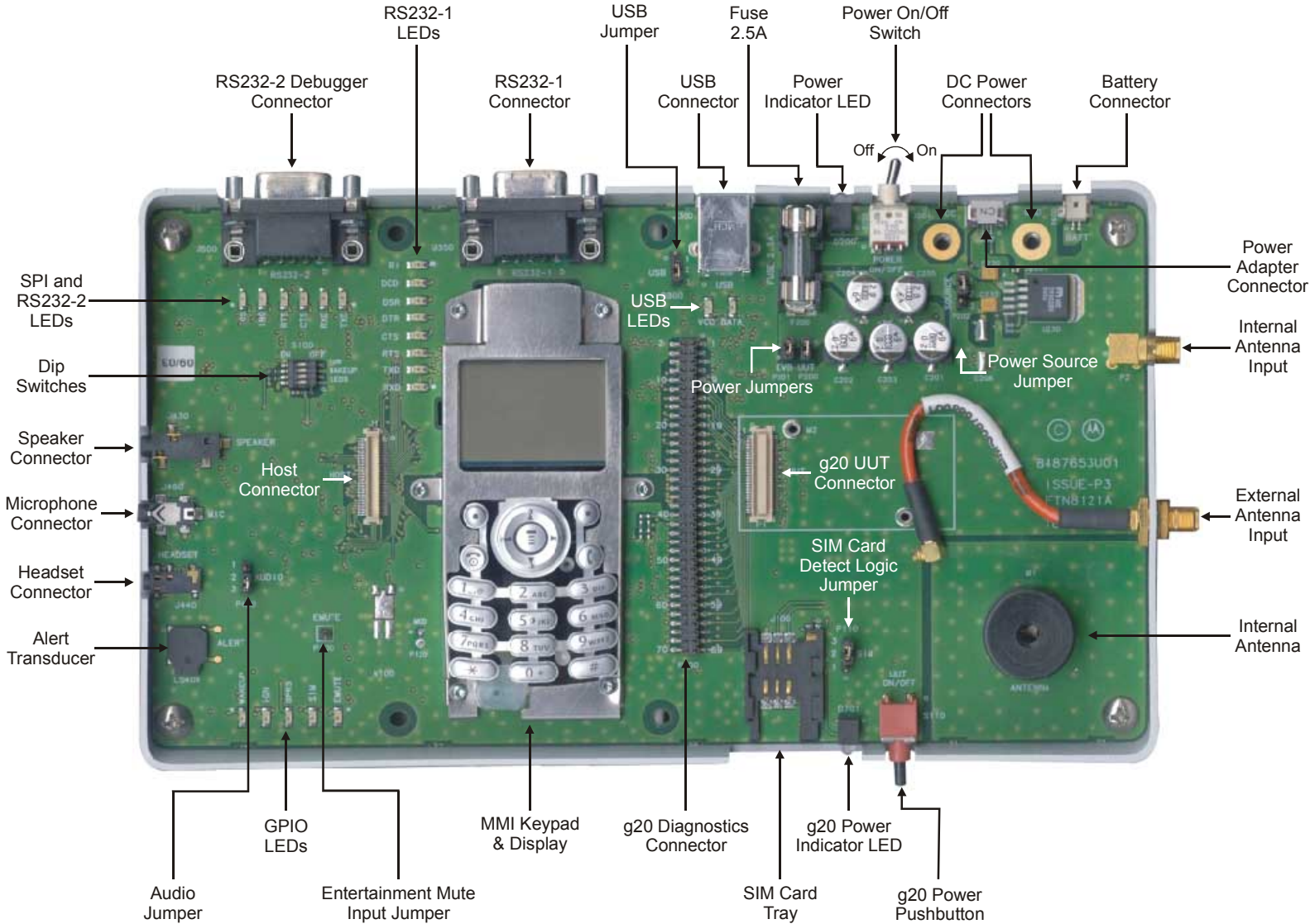


Figure 7. Developer Board Components

3.3 INITIAL SETUP

This section describes the initial procedure for setting up the g20 Developer Board for testing and evaluating of the g20. The tasks in this section need to be performed only once, before the first time you use the g20 Developer's Kit. After performing the initial setup, you can modify the default settings or use different peripheral devices, as described in “Configuration” on page 14.

Perform the steps in this section in sequence.

Before starting, remove the cover of the Developer Board. The cover simply slides up off the board, and does not require the removal of any screws or clips. After setting up the Developer Board, you can place the cover back on the Developer Board by simply pushing it gently back into place. Make sure the cover is aligned properly with the external connectors on the side of the board.

3.3.1 g20

The Developer Board works with all versions of the g20. There are four versions of the g20:

- European version
- European version with USB driver
- North American version
- North American version with USB driver

Connect the g20 to the Developer Board by performing the following steps:

- Place the g20 into the area on the Developer Board marked by a white rectangle, and push the g20 70-pin connector down into the UUT 70-pin connector (P1). The two screw holes on the g20 should be aligned with the g20 spacers (M2 and M3).
- Fasten the g20 to the Developer Board using the two M2 screws provided with the kit.

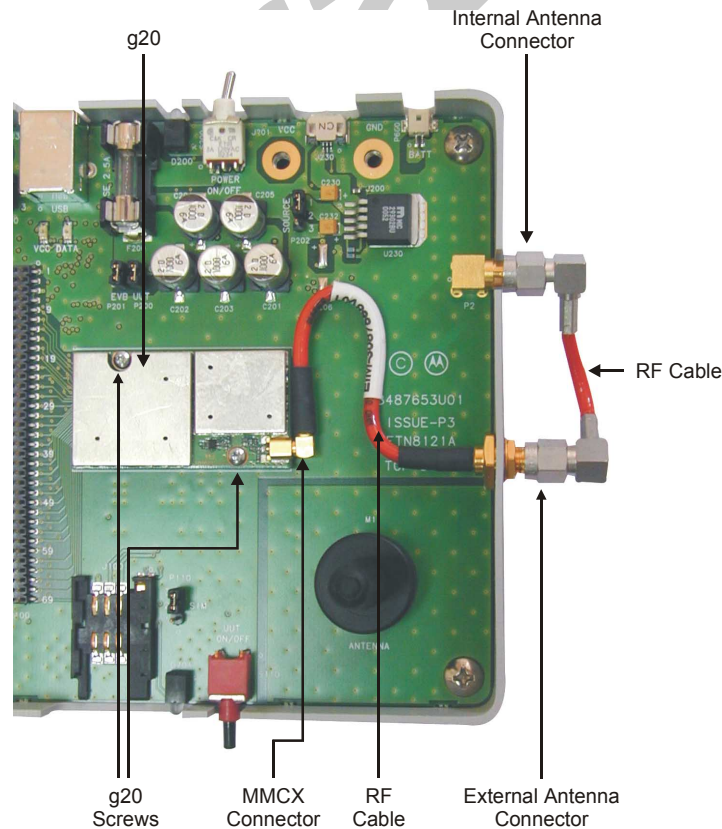


Figure 8. Connecting the g20

- An RF cable with an MMCX connector is connected to the external antenna connector. Connect the RF cable's MMCX connector to the MMCX connector of the g20 by pushing it in until it clicks. This connects the g20 to the antenna.

3.3.2 USB Driver

If you are using a g20 with a USB driver, you must set the USB jumper (P300), located next to the USB connector, in order to indicate that the g20 and not the Developer Board is providing the USB driver.

Connect the USB jumper (P300) between pins 1 and 2.

For more information on the USB jumper, refer to “Configuration” on page 14.

3.3.3 External Connectors

Place the cover back on the Developer Board and connect the following external connectors.

3.3.3.1 Power Supply

Make sure the Developer Board power switch is off before connecting the power supply.

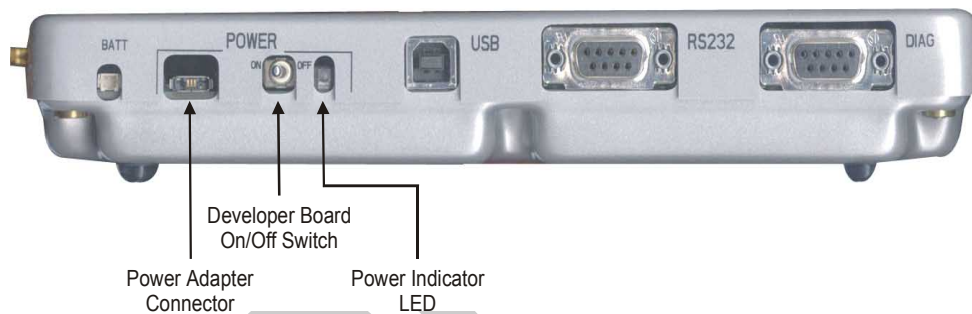


Figure 9. Developer Board Power Switch and Adapter Connector

Connect the power adapter to the Developer Board adapter connector (J230), which is labeled Power on the cover of the Developer Board. Plug the adapter into a wall outlet.



Note

The g20 Developer Board can also be powered by an external DC power supply or battery cell. These options are described in “Configuration” on page 14.

3.3.3.2 PC Connection

USB and RS232 serial interfaces are available for PC communications. If a PC connection is required, connect either a RS232 cable with a male D-type connector to the RS232-1 labeled UART1 connector (J350), or a USB cable with a B-type connector to the USB labeled connector (J300).

The g20 Developer's Kit includes the necessary RS232 and USB cables.

3.3.3.3 Audio Devices

Connect the headset, which includes a headphone and a microphone. You can instead connect the speaker and microphone, which are optional accessories.

The jacks for these devices are on the left side of the Developer Board and labeled on the board as follows:

- Headset: HEADSET (J440)
- Microphone: MIC (J460)
- Speaker: SPEAKER (J430)

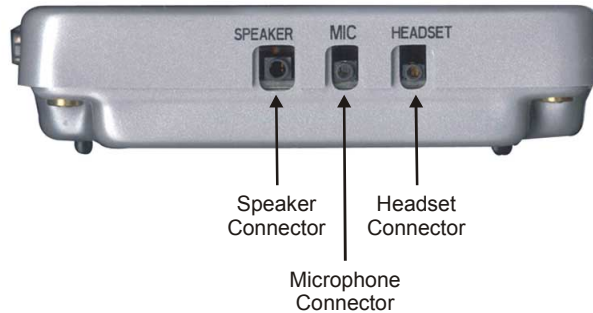


Figure 10. Audio Connectors

You can use the speaker and microphone together or use each one by itself. You cannot use the headset while using either the speaker or microphone.

3.3.3.4 SIM Card

Insert a SIM card into the SIM tray (J100) with the contacts down and the cut-off corner to the front and right. A diagram on the cover indicates how to insert the SIM.



Figure 11. SIM Tray

A test SIM card is provided with the g20 Developer's Kit.

3.3.3.5 Antenna

Connect the additional RF cable from the EXT ANT connector to the INT ANT connector. This connects the g20 to the on-board internal antenna.

3.3.3.6 Power Up

You must turn on the Developer Board power and then turn on the g20.

- Turn on the Developer Board power by switching on the power switch (S200). The Developer Board power indicator LED is lit.
- Turn on the g20 by pushing in the g20 on/off switch (S110), holding it in for about a second and then releasing it. You can also turn on the g20 by pressing and holding the red function button on the keypad. (The red button also functions as the end-call button.) The g20 on/off LED is lit and the display above the keypad shows text.

The Developer Board is now ready for use.

3.4 CONFIGURATION

After performing the initial setup in the previous chapter, you can use the Developer Board with the default setup. This section describes how to change this setup in order to use different peripherals or to change the way the board operates.

3.4.1 Alternate Power Sources

Developer Board power can be supplied from an AC power adapter, external DC power source or battery. The same power source is used for the g20 and the board peripherals.

You must connect the Developer Board to a power source, and then set the power source jumper (P202), if necessary.

There are two other jumpers that help control the power supply in the Developer Board:

- **P201:** Connects/disconnects the power from the Developer Board peripherals
- **P200:** Connects/disconnects the power from the g20

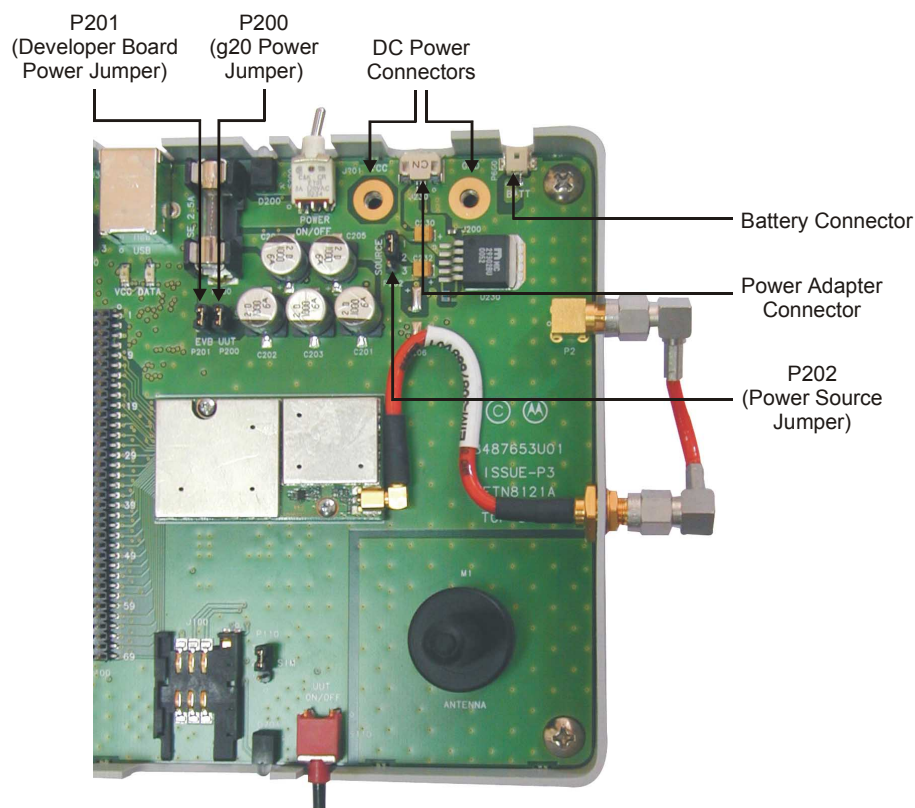


Figure 12. Power Supply Connectors, Jumpers and Switches

Each power supply option is described in the sections that follow.

3.4.1.1 AC Adapter Operation

When using an AC adapter, the adapter is connected to the power adapter connector (J230). The adapter supplies a constant 4.5 V, which is regulated to a nominal 4.1 V on the Developer Board.

Table 4. Power Adapter Connector Pinout (J230)

Pin #	Pin Name
1	GND
2	Detection circuit
3	VCC

3.4.1.2 DC Power Source Operation

You can use an external DC power supply by connecting it to the VCC (J201) and GND (J200) connectors.

The supplied DC input connectors must be attached to the Developer Board in order to use an external DC power source. Use the red connector for VCC and the black one for GND. Connect the DC power source to these connectors using banana plugs, alligator clips or wire.

The DC voltage applied through this connection should not exceed the recommended operational limits of 3 V to 4.2 V. In all cases, the DC source input is protected from over voltage and reverse polarity, and includes a 2.5A protective fuse.



It is recommended to remove jumper P202 when using the DC power source. The DC power source should not be used when other sources are connected.

3.4.1.3 Battery Operation

The Developer Board supports a battery power supply. The battery used must be a 3.6V lithium-ion cell, corresponding to Motorola part number 0189727L01. The battery is an optional accessory.

When using a battery as the main power source, the AC adapter input operates as a battery charger, which connects to an on-board battery charging circuit.

Table 5. Battery Connector Pinout (P600)

Pin #	Pin Name
1	VCC
2	GND

3.4.1.4 Power Source Selection

The Developer Board AC adapter and battery power inputs include a selection jumper (P202) that diverts either the regulated AC adapter power or the battery power to the board.

Table 6. Power Source Jumper (P202)

P202 Jumper Position			Selected Mode	Power Source
1	2	3		
•	•		Adapter	AC Adapter
	•	•	Battery	Lilon Battery
			Adapter and battery disconnected	DC power only

Jumpers are provided for disconnecting the power from the Developer Board and for disconnecting the power from the g20.

You may wish to remove the Developer Board power jumper and shut off the power to the board in order to diagnose a problem that may be caused by the board. The g20 will continue to receive power.

You may also want to remove the g20 power jumper and then connect an amperometer to the jumper's two pins to measure the current through the g20.

Table 7. Developer Board Power Jumper (P201)

P201 Jumper Position		Selected Mode
1	2	
•	•	Developer Board connected to power source
		Developer Board disconnected from power source

Table 8. g20 Power Jumper (P200)

P200 Jumper Position		Selected Mode
1	2	
•	•	g20 connected to power source
		g20 disconnected from power source

3.4.2 Communication Interfaces

The g20 Developer Board includes three serial interfaces:

- RS232
- USB
- SPI

The RS232 and USB ports are multiplexed within the g20, and therefore cannot be operated simultaneously. The default connection is RS232.

The USB and RS232 is not detected dynamically. The selected serial connection is determined by the USB cable connection at power up. If the USB cable is connected (and the PC is on), then USB is selected. Otherwise, RS232 is selected.

The SPI RS232 interface is used for debugging.

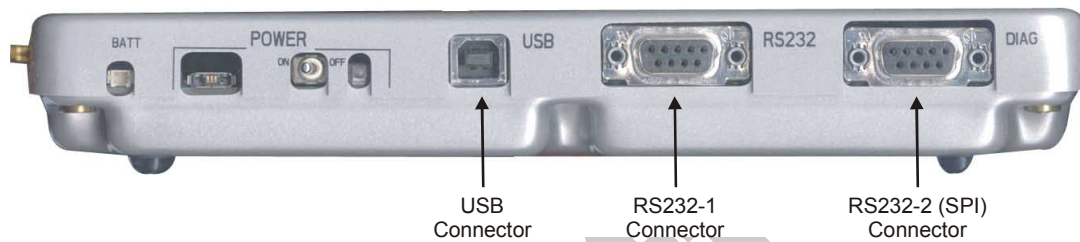


Figure 13. USB, RS232 and DIAG (SPI) Connectors

Each of these serial interfaces is described in the sections that follow.

3.4.2.1 RS232

The 9-pin, D-type RS232-1 serial port (J350) is the primary interface to the g20 UUT. The UUT RS232 signals are active-low CMOS-level signals (0-2.7 V), which are converted by the Developer Board to standard RS232 levels for PC communications.

Table 9. RS232-1 Connector Pinout (J350)

Pin #	Description	DTE I/O
1	DCD	In
2	RXD	In
3	TXD	Out
4	DTR	Out
5	Ground	
6	DSR	In
7	RTS	Out
8	CTS	In
9	RI	In



Note

The RS232-1 connector pin names are DTE-oriented.

3.4.2.2 USB

The USB interface (J300) operates according to the g20 UUT configuration. The Developer Board has a complete USB transceiver circuit to support USB communications for g20 units that do not include a USB driver of their own. The Developer Board USB interface can be overridden manually when using a g20 unit that does include its own USB driver interface.

Table 10. USB Connector Pinout (J300)

Pin #	Description
1	VCC
2	D-
3	D+
4	Ground

The USB jumper (P300) located next to the USB connector selects between the Developer Board USB interface and the UUT USB interface. By changing the jumper position, the USB_VBUS signal is diverted to the selected driver (in the g20 or on the Developer Board) and operates it.

Table 11. USB Jumper (P300)

P300 Jumper Position			Selected Mode	USB Source
1	2	3		
•	•		g20	g20 driver
	•	•	EVB (Developer Board)	EVB driver
			USB disconnected	

3.4.2.3 SPI

The 9-pin D-type RS232-2 serial port (J500) is connected to the g20 internal SPI bus. This interface is used to debug applications. On the Developer Board, the g20 SPI interface is converted to standard RS232 signals for PC communications. The conversion process uses the RS232 interface as a second slave on the internal g20 SPI bus, and communicates with it as such. SPI read and write operations are performed normally, using the CS and IRQ signals provided by the conversion circuit. The IRQ signal is connected to a g20 IRQ pin.

Table 12. RS232-2 Connector Pinout (J500)

Pin #	Description	DTE I/O
1	Unused	
2	RXD	In
3	TXD	Out
4	Unused	
5	Ground	
6	Unused	
7	RTS	Out
8	CTS	In
9	Unused	



Note

The RS232-2 connector pin names are DTE-oriented.

3.4.3 Audio Interface

The Developer Board includes analog and digital audio interfaces. The audio interface contains a hands-free speaker and microphone, a headset, and an alert transducer.

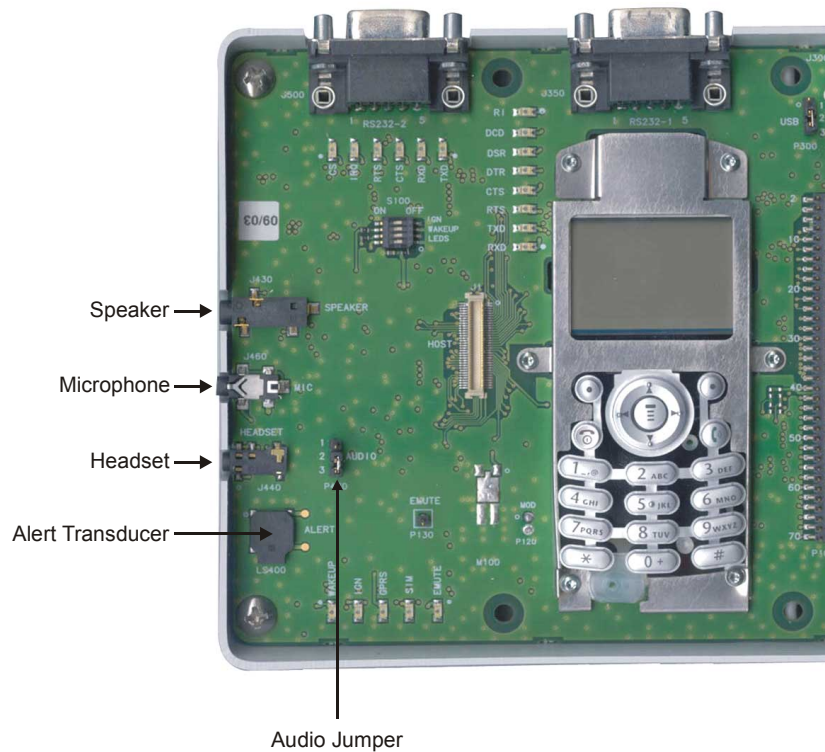


Figure 14. Audio Connectors and Jumper

3.4.3.1 Speaker

The differential speaker interface is designed as a hands-free speaker. The Developer Board uses an audio amplifier to amplify the speaker audio output to desired levels. The speaker connector (J430) is labeled SPEAKER. The speaker output is 8 ohms matched.

Table 13. Speaker Connector Pinout (J430)

Pin #	Description
1	Not connected
2	Speaker positive output
3	Speaker negative output
4	Not connected

3.4.3.2 Microphone

The microphone interface is designed as a hands-free microphone. The microphone connector (J460) is labeled MIC.

Table 14. Microphone Connector Pinout (J460)

Pin #	Description
1	Ground
2	Microphone audio-in
3	Ground
4	Ground
5	Ground

3.4.3.3 Audio Source Selection

Microphone and speaker audio can be routed through two different sources: the g20 audio amplifiers or the g20 digital audio interface. The Developer Board includes a CODEC that converts the g20 digital audio data to analog audio signals.

The P420 jumper selects the speaker and microphone source, as indicated in Table 15. This enables you to test the digital or analog audio channels.

Table 15. Audio Jumper (P420)

P300 Jumper Position			Selected Mode	USB Source
1	2	3		
•	•		Digital audio	CODEC audio I/O
	•	•	Analog audio	G20 audio I/O
			Audio disconnected	

3.4.3.4 Headset

The headset interface is designed as a portable phone audio interface, and is similar to a phone headset interface. The headset connector (J440) includes a speaker, microphone and a detection signal. The speaker and microphone signals are directly connected to the g20 audio signals.

The purpose of the detection circuit is to switch the g20 headset audio paths on and off, whenever a headset connection is detected. Headset detection is made whenever a headset plug is inserted into the jack. This action disables the g20 microphone and speaker, and routes the audio signals to the headset.

Table 16. Headset Connector Pinout (J440)

Pin #	Description
1	Ground
2	Headset-detect switch
3	Speaker audio-out
4	Microphone audio-in
5	Ground

3.4.3.5 Alert Transducer

The Developer Board includes an on-board transducer, labeled ALERT, for alert audio sounds (LS400). The transducer is connected directly to the g20 differential alert outputs. The alert transducer sounds the g20 MIDI signals.

Table 17. Alert Transducer Pinout (LS400)

Pin #	Description
1	Alert audio inverted output
2	Alert audio positive output
3	Alert audio inverted output
4	Alert audio inverted output

3.4.4 External Antenna

An antenna (internal or external) must be connected to the Developer Board for adequate GSM reception. You can connect the g20 to either the on-board internal antenna or to an external antenna.

Two RF connectors on the side of Developer Board, labeled INT ANT and EXT ANT on the cover, are used for setting up the antenna.

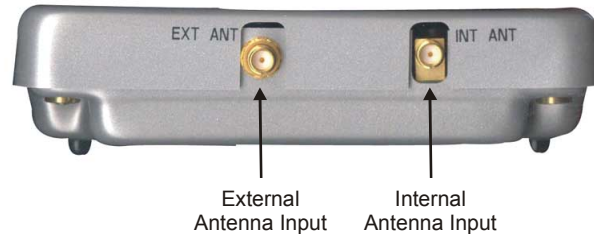


Figure 15. Antenna Connectors (external)

On the inside of the Developer Board, the EXT ANT connector is connected to the g20 and the INT ANT is connected to the on-board internal antenna.

You must perform one of the following:

- To use the internal antenna, connect the EXT ANT and INT ANT connectors with the additional RF cable supplied in the Developer's Kit.

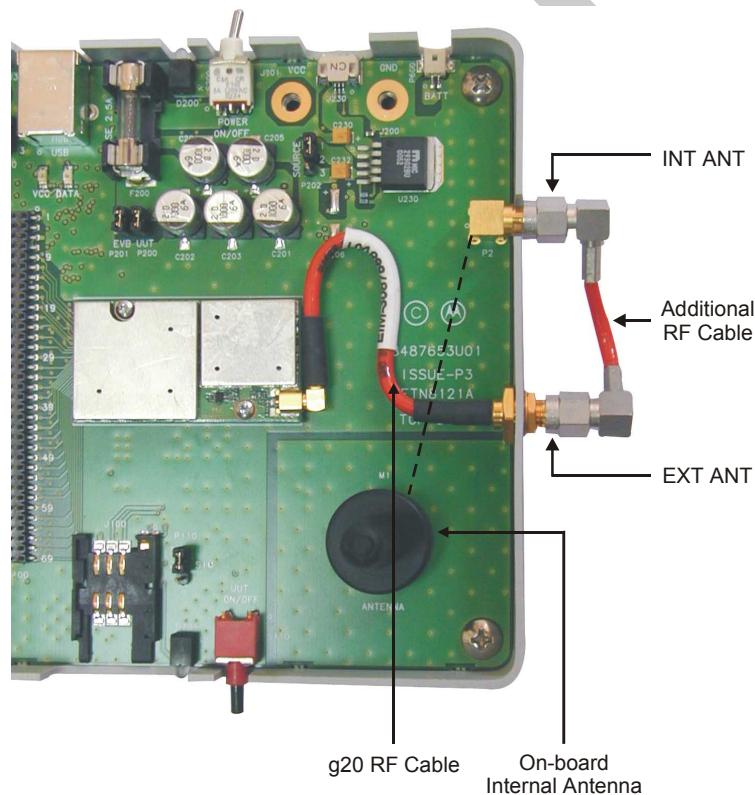


Figure 16. Antenna Connectors (internal)

- To use an external antenna, connect an external antenna or antenna application to the EXT ANT connector. (The connection cable is not included.)

3.4.5 Ignition

The Developer Board contains an on/off Dip switch, labeled IGN, that is connected to the g20 UUT ignition circuit. You can use this Dip switch to turn on and off the g20.

3.4.6 Wakeup

The Developer Board includes a wakeup Dip switch, labeled WAKEUP, that toggles the g20 WAKEUP_IN_N signal.

Generally, your application wakes up the g20. In cases where the application is not ready for integration, you can force wakeup of the g20 by turning on this Dip switch.

3.4.7 LEDs Logic and Control

The Developer Board includes LED indicators for critical signals. A 3.0V regulator powers the LEDs.

A Dip switch enables you to turn off all the LEDs on the Developer Board, for example, to reduce power consumption. The Developer Board power on/off LED and the g20 on/off LED are always active and cannot be disabled.

3.4.8 SIM Card

The SIM card connector (J100) is external to the UUT, but is connected directly to it, similar to an internal SIM. The UUT can accept 1.8V and 3V SIM cards.

Table 18. SIM Connector Pinout (J100)

Pin	Description
1	Ground
2	Presence detect
3	Clock
4	Reset
5	VCC
6	Serial data I/O
7	VPP
8	Ground

Use the SIM card detect logic jumper (P110) to choose active-high or active-low detection configurations.

Table 19. SIM Card Detect Logic Jumper (P110)

P110 Jumper Position			Selected Mode
1	2	3	
●	●		Active-low
	●	●	Active-high
			Not active

3.4.9 Host

An external application may communicate with the g20 through the host connector (J1) and control some or all of the g20's functions. The host connector enables you to integrate the g20 into an application without installing the g20 inside the product.

The host connector operates in parallel with the developer board peripherals and enables an external application to share g20 resources with the developer board. You may select any g20 function to control externally, through the host connector, and allow the developer board to control other functions.

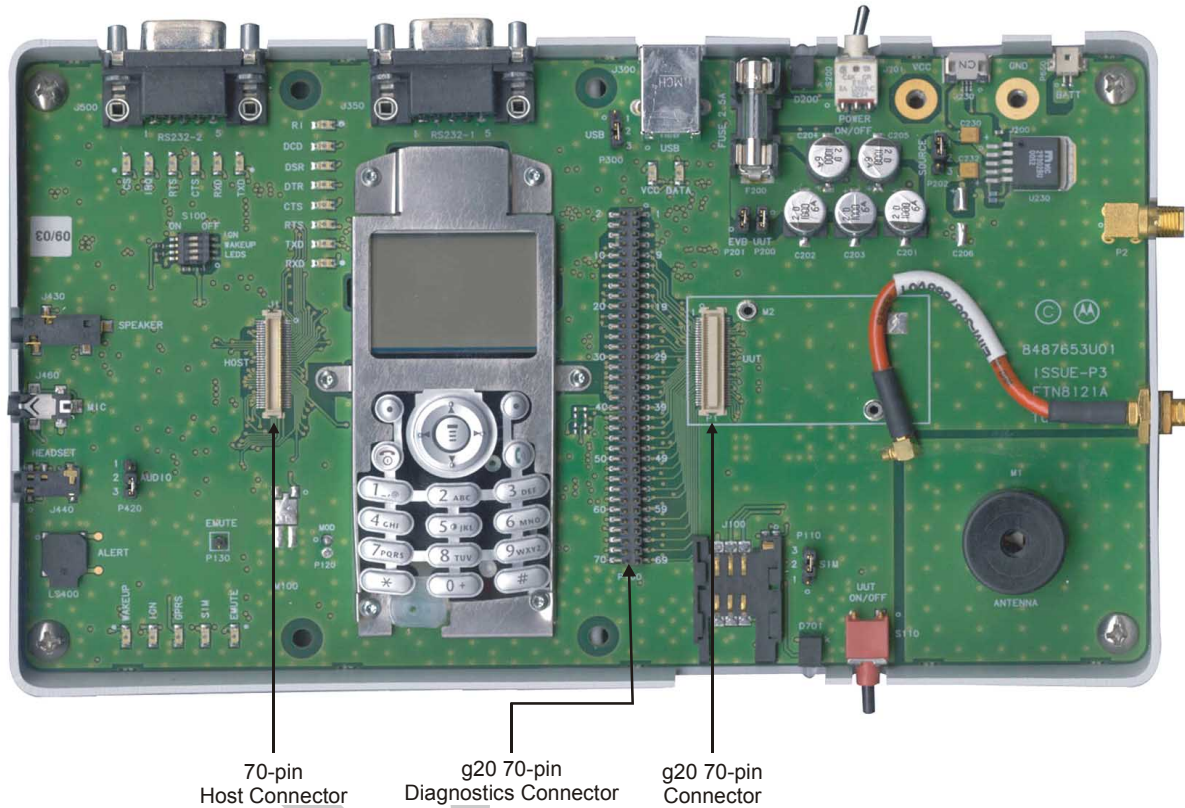


Figure 17. 70-pin Connectors

You can connect an external application to the g20 Developer Board using a host interconnect flex cable and connecting it to the host connector (J1). Connect the other end of the cable to the external application. The cable is an optional accessory.

All pin numbers and functions of the host connector are identical to those of the g20 UUT (P1) and the g20 diagnostic connector (P100). For more information on the pins of the host connector, refer to “UUT Interface Connector” on page 27.

The following are guidelines for using the host connector:

- When using an external SIM card through the host connector, the developer board SIM card jumper (P110) must be disconnected and the SIM card tray should be empty.
- When using any of the serial communication channels (USB, RS232, SPI) through the host connector, the developer board serial connectors should not be used.
- When using the IGN or WAKEUP functions through the host connector, the functions should be switched off on the developer board Dip switches.
- When using the analog audio channels through the host connector, disconnect all audio devices from the developer board.
- When using the PCM digital audio through the host connector, it is recommended to place the audio selection jumper (P420) to analog audio mode.
- When connecting an external application that provides the power to the g20 and the Developer Board, remove any other power sources from the Developer Board.

3.5 COMPONENTS AND SPECIFICATIONS

3.5.1 Connectors Description

All the Developer Board connectors are marked by their reference number and by a pin-1 indicator. Table 20 describes the available connectors on the Developer Board.

Table 20. Connectors

Reference	Connector	Description
Internal Connectors (not visible when cover is on)		
P1	g20 UUT	g20 UUT (unit under test) connector
J1	Host	Emulates the g20 connector for host systems
P100	Diagnostics	Debug header connector (70-pin)
J201	VCC	Developer Board DC power supply
J200	GND	Developer Board common ground
External Connectors (visible when cover is on)		
J300	USB	USB B-type connector
J350	RS232-1	Primary RS232 to PC
J500	RS232-2	Secondary RS232 for debugging (SPI)
J430	Speaker	Hands-free system speaker jack
J460	Microphone	Hands-free system microphone jack
J440	Headset	Headset jack
P600	Battery	Battery connector
J230	AC adapter/charger	Wall-mount adapter connector (CE bus compatible)
J100	SIM card	SIM card socket with detection
P2	Antenna connector	SMA connector internal antenna
M1	RF Antenna	SMA connector for external antenna

3.5.1.1 UUT Interface Connector

Table 21 lists the pin names and functions available for the g20 interface connectors. All pin numbers and functions are identical for the g20 UUT (P1), host (J1) and g20 Diagnostic (P100) connectors on the Developer Board.

Table 21. g20 Connectors Pinout

Pin #	Pin Name	Pin #	Pin Name
1	GND	2	GND
3	GND	4	GND
5	VCC	6	VCC
7	VCC	8	VCC
9	RTS_N	10	USB_DET
11	RXD_N	12	Not connected
13	DSR_N	14	Not connected
15	CTS_N	16	WAKEUP_IN_N
17	DCD_N	18	PCM_DIN
19	DTR_N	20	PCM_DOUT
21	TXD_N	22	PCM_CLK
23	RI_N	24	PCM_FS
25	RESET_N	26	WAKEUP_OUT_N
27	BL_SINK	28	KBC1_N
29	CHRG_DIS	30	KBC0_N
31	CHRG_SW	32	KBR0_N
33	CHRG_STATE	34	KBR1_N
35	CHRG_DET_N	36	KBR2_N
37	Not connected	38	KBR3_N
39	TX_EN_N	40	KBR4_N
41	Not connected	42	KBR5_N
43	VIB_OUT	44	SIM_RST_N

Table 21. g20 Connectors Pinout (Continued)

Pin #	Pin Name	Pin #	Pin Name
45	CHRG_TYP	46	SIM_CLK
47	THERM	48	SIM_VCC
49	GPRS_DET_N	50	SIM_PD
51	IGN	52	SIM_DIO
53	ON_OFF_N	54	LCD_CS
55	HDST_INT_N	56	LCD_DATA
57	HDST_MIC	58	LCD_CLK
59	MIC_GND	60	LCD_RS
61	MIC	62	SPI_IRQ_N
63	ALRT_N	64	SPI_DIN
65	ALRT_P	66	SPI_CLK
67	SPKR_N	68	SPI_DOUT
69	SPKR_P	70	SPI_CS

3.5.2 Switches and Jumpers

Figure 18 shows the jumpers and switches on the Developer Board.

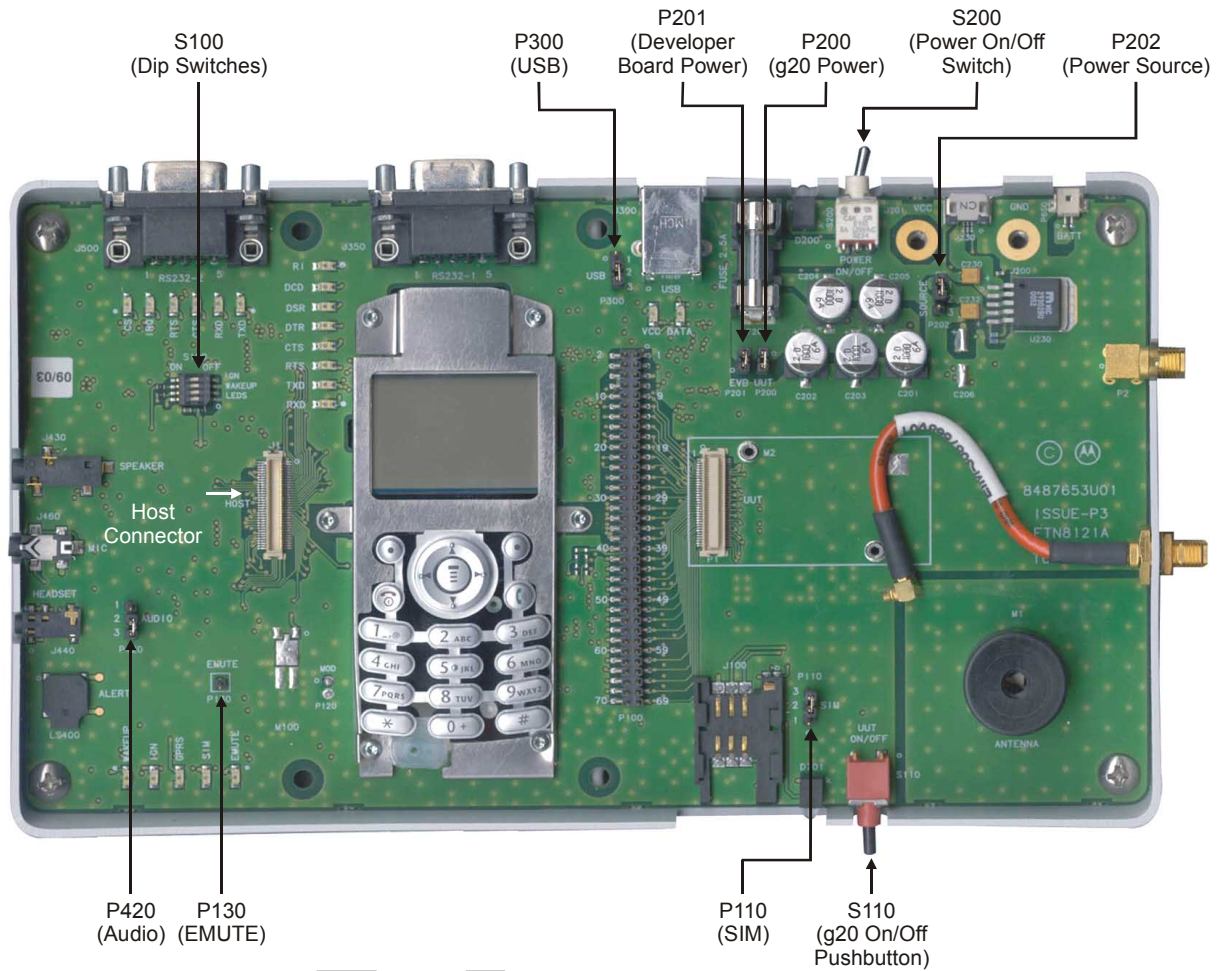


Figure 18. Jumpers and Switches on Developer Board

Table 22 describes the available switches and jumpers on the Developer Board.

Table 22. Switches and Jumpers

Reference	Switch/Jumper	Description
Switches		
S200	Board on/off	Developer Board on/off switch
S110	g20 on/off	g20 on/off pushbutton switch
Dip Switches		
S100	Options switch	Four switches for Developer Board options

Table 22. Switches and Jumpers (Continued)

Reference	Switch/Jumper	Description
Jumpers		
P420	Audio	Analog/digital audio-selection jumper
P201	EVB	Peripheral power input jumper
P200	UUT	g20 UUT power input jumper
P202	Source	Power source selection jumper
P110	SIM	SIM card detect logic selection jumper
P300	USB	USB driver source selection jumper
P130	EMUTE	Entertainment mute connection point

3.5.2.1 Dip Switches

Figure 19 shows the Dip switches provided on the Developer Board, which are located on the S100 component.

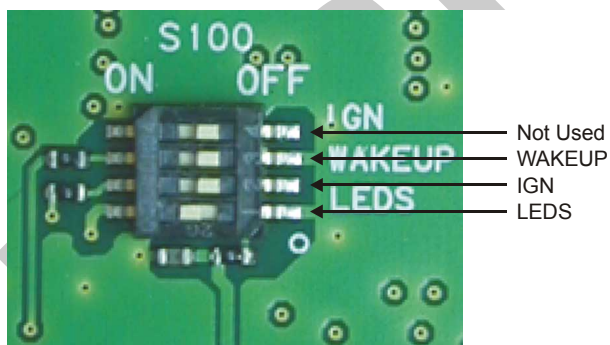


Figure 19. Dip Switches

The following Dip switches are provided:

Table 23. Dip Switches

Reference	Description
WAKEUP	g20 wakeup signal
IGN	g20 ignition circuit
LEDS	on/off switch for LEDs

3.5.3 LED Indicators

Figure 20 shows the LEDs on the Developer Board.

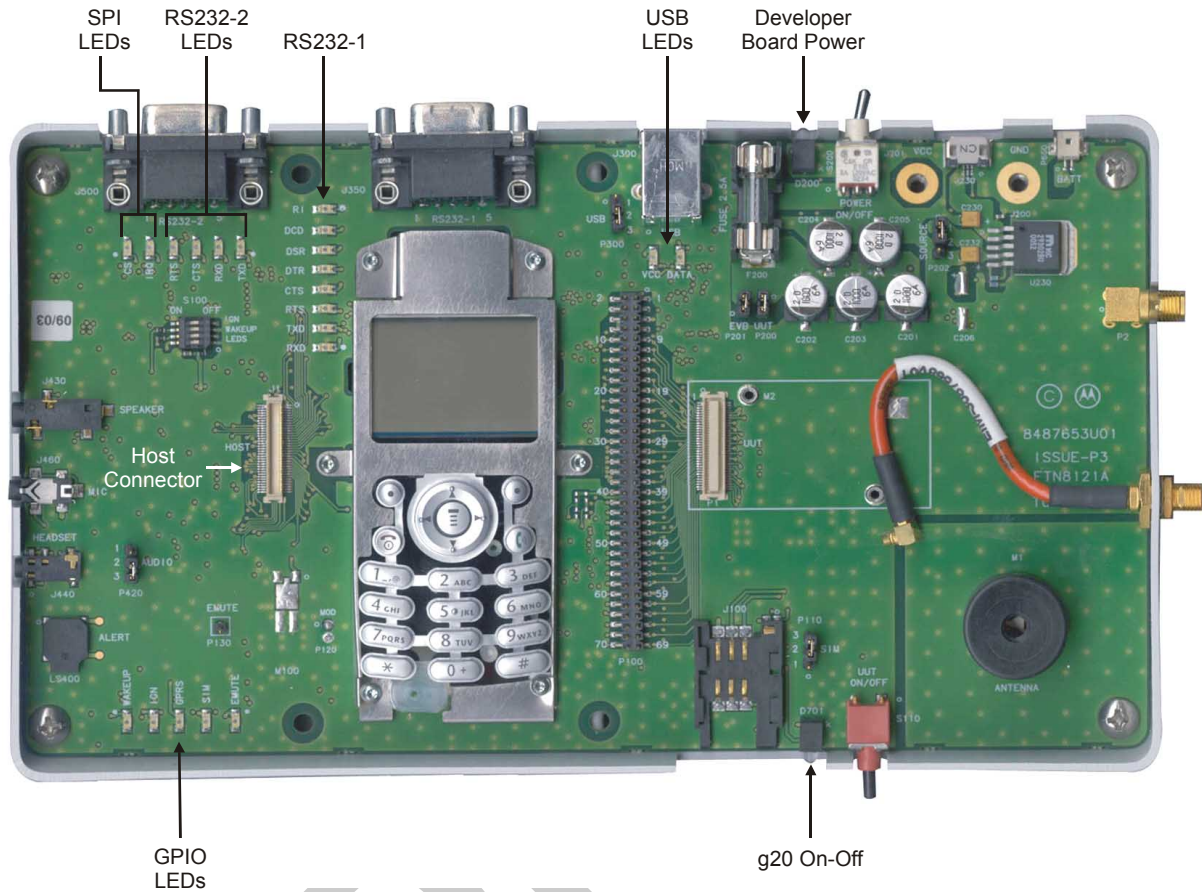


Figure 20. LEDs on Developer Board

Table 24 describes the LED indicators on the Developer Board. Each LED is marked on the board by the function it represents.

Table 24. LEDs

Group	LED	Reference	Description
GPIO	WAKEUP	D704	Wake-up in/out
	IGN	D702	Ignition input
	GPRS	D710	GPRS coverage indication
	SIM	D703	SIM card reset indication
	EMUTE	D708	Entertainment mute indicator
Power	UUT	D701	g20 on/off
	PWR	D200	Power

Table 24. LEDs

Group	LED	Reference	Description
SPI	CS	D741	SPI chip-select output
	IRQ	D744	SPI IRQ input
USB	VCC	D760	USB VBUS
	DATA	D761	USB D+
RS232-1	RXD	D722	DTE receive data
	TXD	D721	DTE transmit data
	RTS	D724	Request to send
	CTS	D723	Clear to send
	DTR	D725	Data terminal ready
	DSR	D726	Data set ready
	DCD	D727	Carrier detect
	RI	D728	Ring indicator
RS232-2	RXD	D743	DTE receive data
	TXD	D742	DTE transmit data
	CTS	D744	Clear to send
	RTS	D745	Request to send

3.5.4 MMI

The Developer Board includes a man-machine interface (MMI), complete with display and keypad. The signals from the display and keypad are directly connected to the UUT interface.

3.5.4.1 Display

The grayscale display (DS800) is not a standalone component, and includes a complete assembly in which it is housed, along with other necessary parts.

Table 25. Display Connector Pinout (DS800)

Pin #	Description
1	Chip select
2	Reset
3	Register select
4	Serial clock
5	Serial data
6	Supply
7	Supply
8	Ground
9	Vout

3.5.4.2 Keypad

Table 26 describes the Developer Board keypad layout.

Table 26. Keypad Functions

Pad Reference	Function	Alternate
S803	1	Punctuation
S802	2	ABC
S820	3	DEF
S801	4	GHI
S805	5	JKL
S804	6	MNO
S806	7	PQRS

Table 26. Keypad Functions (Continued)

Pad Reference	Function	Alternate
S817	8	TUV
S811	9	WXYZ
S809	0	+
S810	Star (*)	
S815	Pound (#)	
S814	Send	
S813	End	On/Off
S819	Menu	
S822	Right	
S823	Left	
S818	Up	
S816	Down	
S812	Soft Right	
S808	Soft Left	

3.5.5 AC Adapter Detection Circuit

The g20 charger module includes a detection logic circuit for detecting charger presence and type. The detection circuit is internal to the g20 module. However, the Developer Board does contain the necessary routing from the g20 UUT to the AC adapter connector.

Two g20 signals are used for this detection:

- **CHRG_TYP:** ADC signal for charger type detection
- **CHRG_SW:** Charger rate control

These detection signals are present to provide compatibility with the phone. They may be removed in future versions.

3.5.6 ADC Test Logic

The g20 includes an additional internal 47k Ω pull-up resistor at each ADC input.

Figure 21 describes the ADC test logic design.

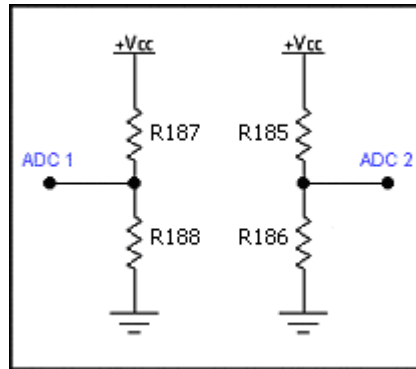


Figure 21. ADC Test Logic Design

3.5.7 Electrical Specifications

Table 27 describes the electrical specifications of the Developer Board.

Table 27. Electrical Specifications

Parameter	Units	Min	Typ	Max
DC power supply	V	3.0	3.6	4.2
Adapter power supply	V	4.4	4.6	12
Battery power supply	V	3.0	3.6	4.2
Off current*	μ A	3.6		42.6
On current	mA	8.0	8.25	8.45
Active current, peripherals off	mA	12.3	12.4	---
Active current, peripherals on**	mA	12.6	---	---

* When using DC power supply only.

** Depends on the active peripherals (LEDs, UART, USB, and so on) in use.

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MECHANICAL DESCRIPTION

4.1 MECHANICAL REQUIREMENTS FOR MOUNTING THE G20 MODULE

The size of the g20 module is 45.2 x 24.4 x 6 mm. Two 2.4-mmØ holes are provided to accommodate M2 screws or #1-64 UNC 2A machine screws. Torque to 2 inches per pound. Refer to Figure 22 below for mounting requirements (dimensions in millimeters):

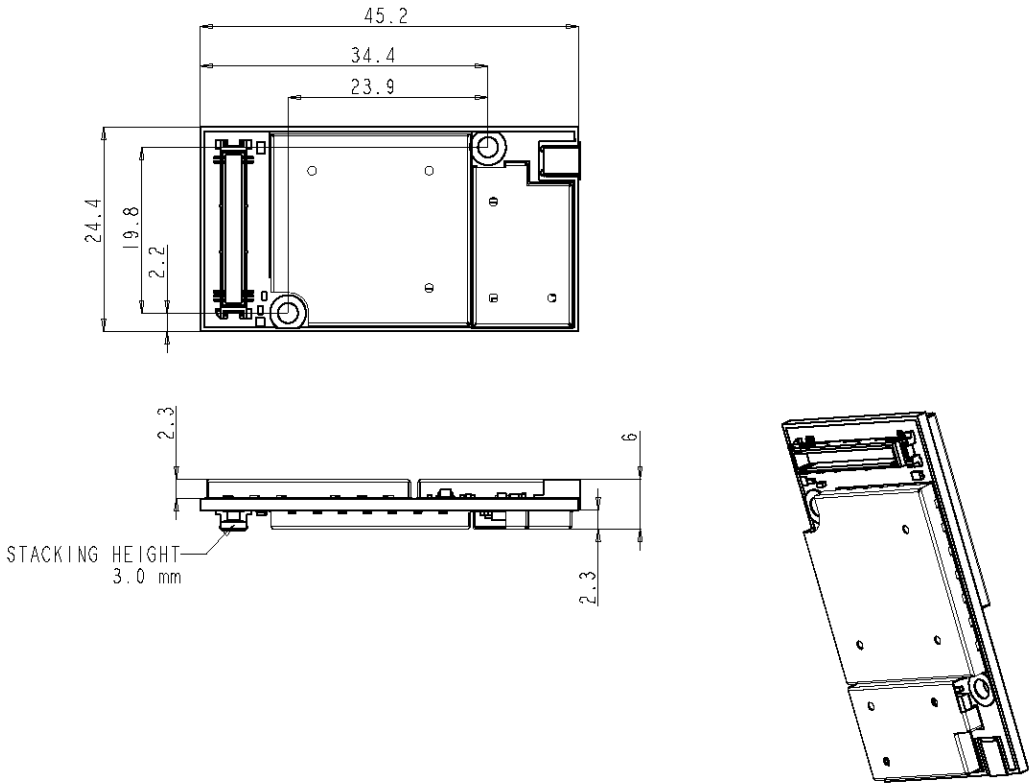


Figure 22. Mechanical Mounting Requirements

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5.1 CUSTOMER ASSISTANCE

This section provides contact information for any possible queries that may arise, such as the following:

- Have questions?
- Having trouble getting the Developer Board set up?
- Technical questions?
- Configuration questions/problems?
- Technical operating problems?
- Need documentation?

The GSM/CDMA Data Module Customer Support Center is ready to assist you on integration issues.

Use the following email address to contact customer assistance: n2cshd@motorola.com



Note

The support services provided by Motorola are subject to the agreement between the customer and Motorola and may be at an additional charge to the customer. Motorola will inform the customer in advance of any such charge.

Every new call/problem report should be directed to the help desk email address noted above. It is recommended to report each individual issue in a separate email. The following information is required when reporting a problem:

- Customer name and address
- Customer contact information for this request, including:
 - Name
 - Telephone
 - Fax number
 - Mobile number
 - Email address
- Product name (for example, d10, d15, g18, Apollo, CP211, and so on)
- Software version of the unit (ATi3 command) or model number
- PCB version. This information is located on the PCB near the RF connector.
- Severity of the problem
- Problem description, including:
 - Operator name
 - Type of SIM card (for example, Test, Pre-paid, or 5v/3v/1.8v)
 - Configuration of the setup (such as Developer Board, handset, host, connections, and so on)
 - Detailed scenario from startup
 - Log of all the commands and the responses, beginning from startup

- Answers to the following questions:
 - Was the same scenario tested on the Developer Board and the PC to reproduce the problem?
 - How many units do you have, and how many of them have this problem?
 - How often does the problem recur?

In addition to the information requested above, send the following AT commands and the HyperTerminal log with the responses:

```
AT+CMEE=2          // To get textual error message
AT+CPIN?            // To get SIM card status
AT+CREG?            // To see if the TXVR is registered to the network
AT+CSQ              // To get the signal strength (RX level)
AT+CGSN             // To read the IMEI number of the unit
AT+CRSM=176,1       // To read the Flex ID
ATI3                // To get the software version of the TXVR
AT\S                // To get the setting of basic AT commands
AT+CMER=0,0,1,1     // To get messages and indicators from the handset display to the DTE
```

5.1.1 Motorola Workflow

The help desk uses the following workflow when responding to new calls:

1. Each new call is registered in the help desk data base.
2. The help desk immediately notifies the customer with the help desk system record number for each issue.
3. A champion is assigned to be responsible for the new call, from arrival to closing.
4. During this time, the champion updates the help desk system with the progress of the resolution process.
5. The champion is the contact to the customer and the engineering team, and coordinates activities that are required to solve the problem.

5.1.2 Service Centers

Motorola Electronics Taiwan PCS
11F, No, 296, Sec. 4, Jen-Ai Road
Taipei, 106, Taiwan, R.O.C

Motorola GmbH
Am Sophienhof 10
D-24941 Flensburg
Germany

Motorola Communications ISRAEL Ltd.

Service Operation

Attention: Shukrun Ofer

3 Kremensky Street

Tel Aviv, Israel 67899

Telephone: (972) 3 5658829

JNB Electronics Pty Ltd.

347 Settlement Road, Thomastown

VIC 3074

Australia

Field service should be coordinated with the Service Manager in Motorola using the following email address:
N2CSFS01@motorola.com

5.1.3 Ordering Accessories

You can order the following accessories for the g20 Developer's Kit:

0189727L01	3.6V Lithium-Ion Battery
0187506V08	Host Interconnect Flex Cable
FSN5527A	Audio Speaker 8Ω
SYN5708D	Audio Microphone (Passive)

To place an order, contact your Motorola account manager. A list of Motorola account managers is available at www.motorola.com/automotive/telematics/. Then, Click Products > Data Modules > Contact Us.

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SCHEMATICS, PLACEMENT AND PARTS LIST

6.1 SCHEMATICS

This section presents the schematics for the g20 Developer Board.

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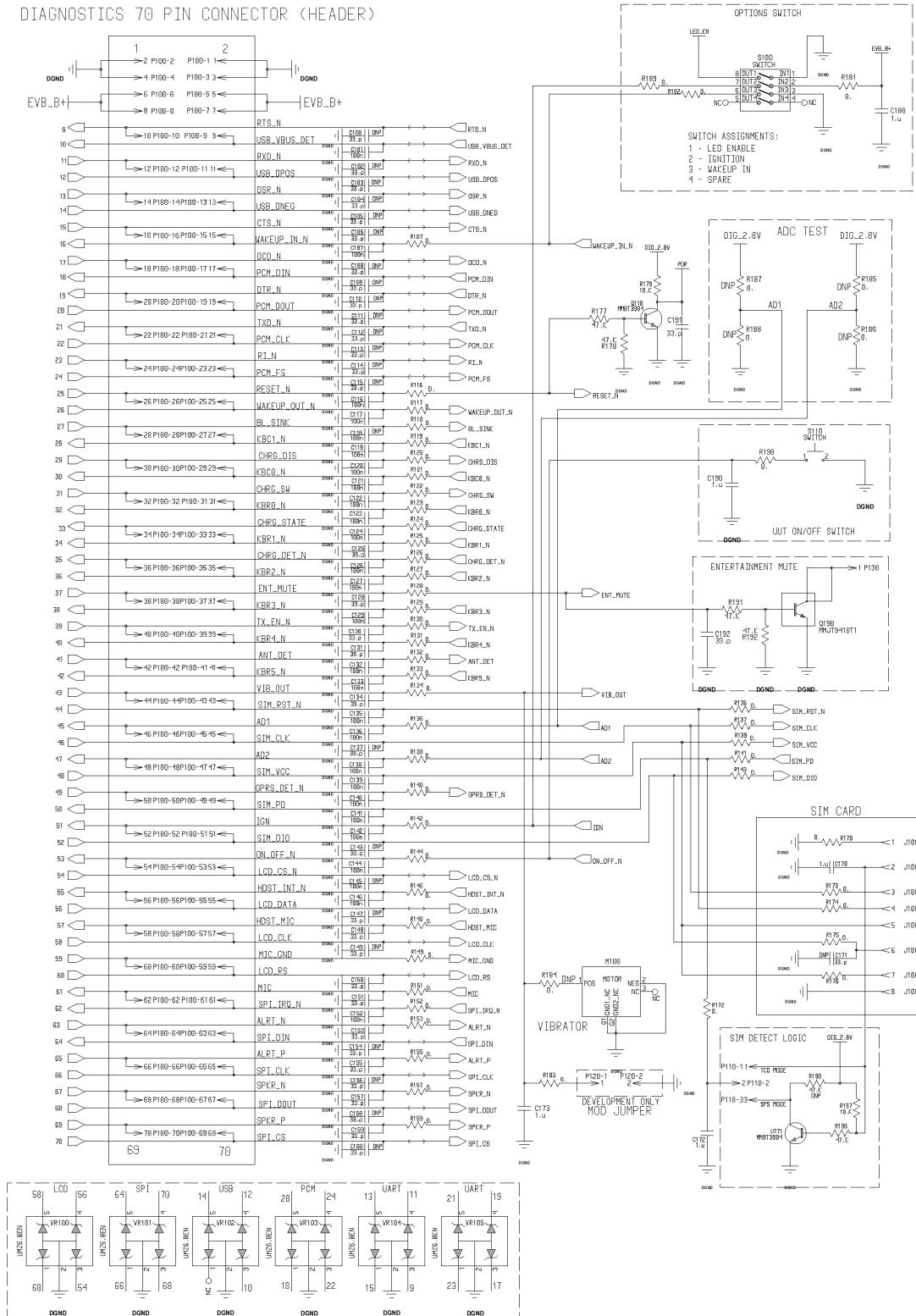


Figure 24. Diagnostics

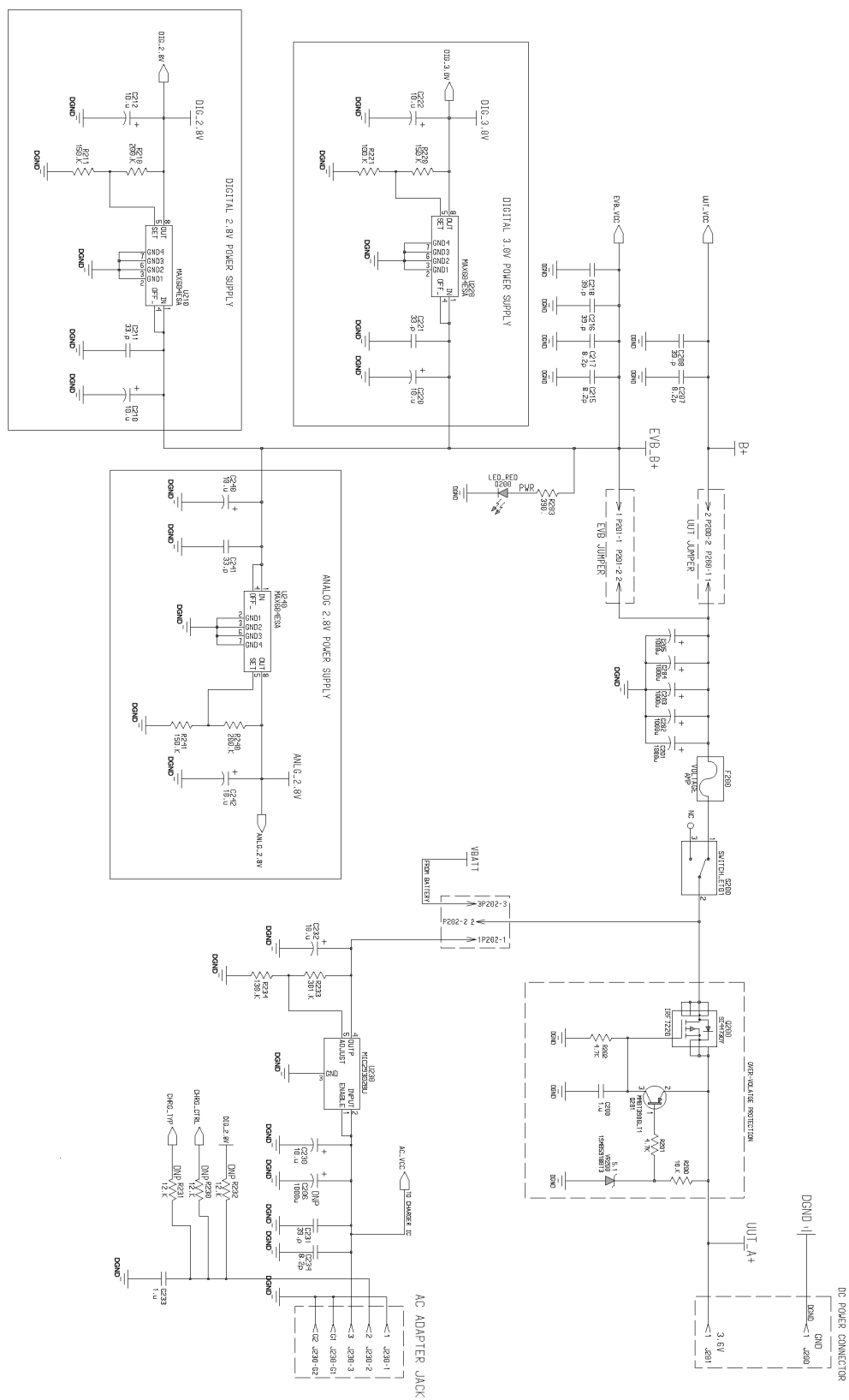


Figure 25. Power

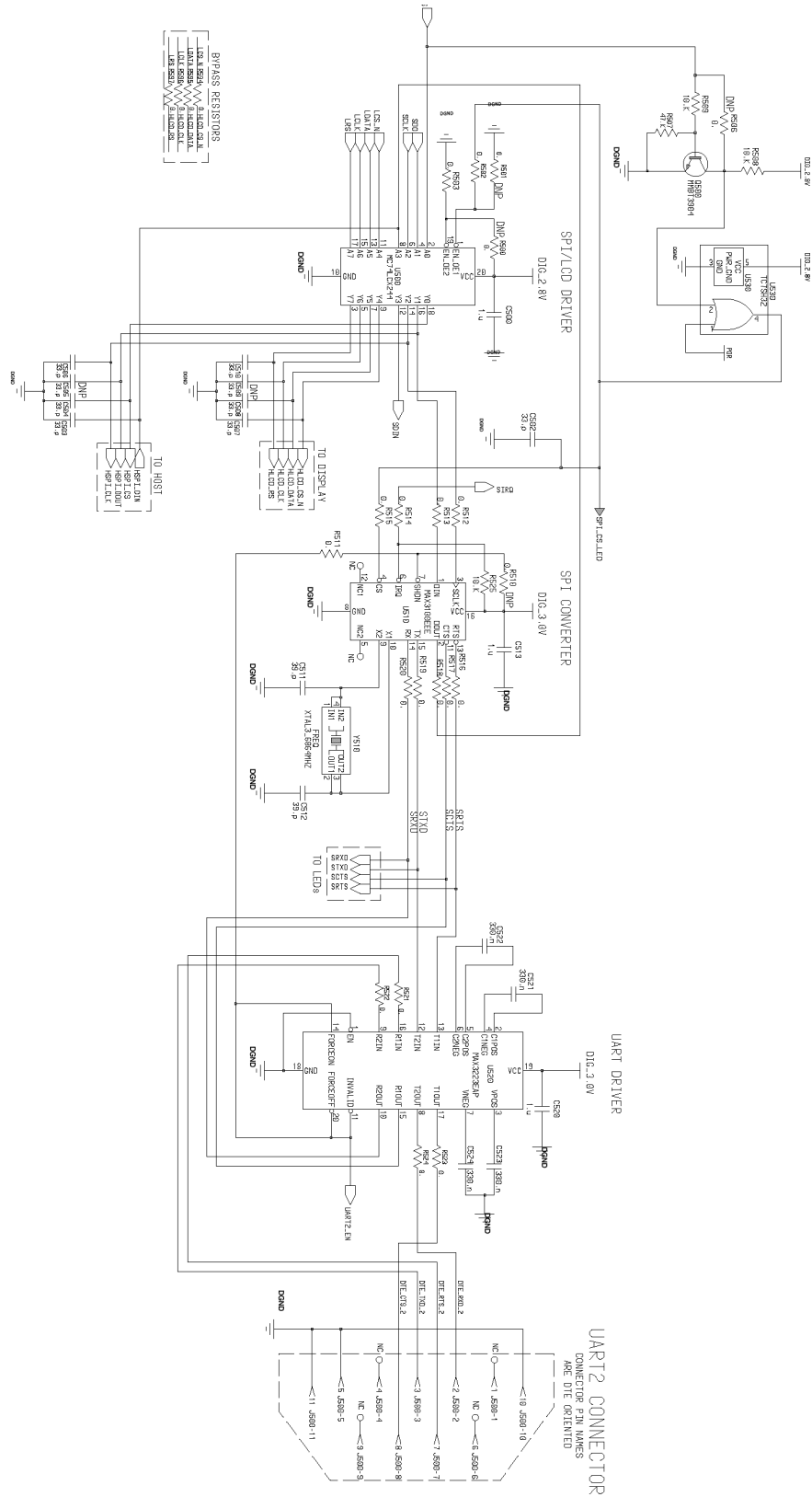


Figure 26. Debug Interface

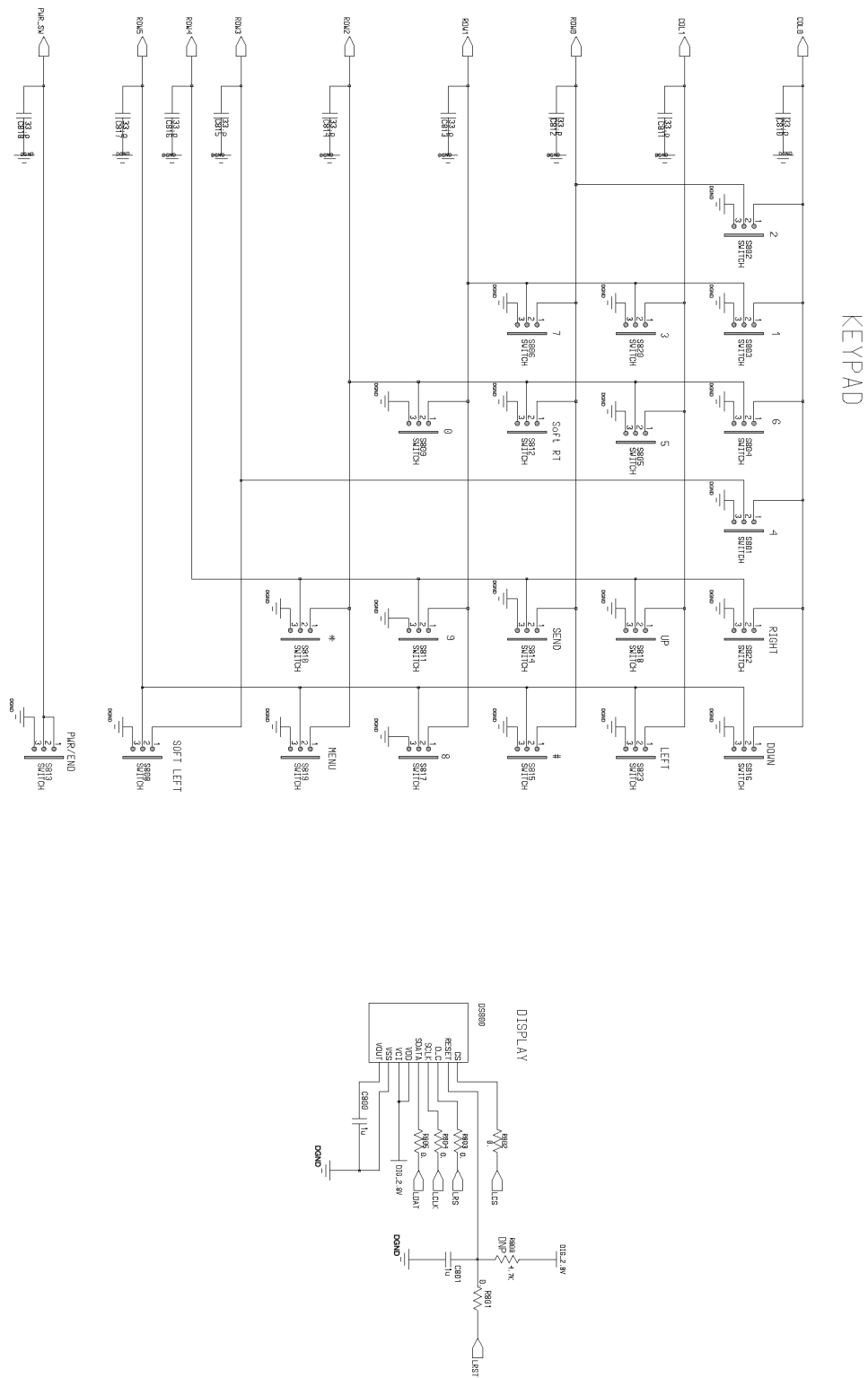


Figure 27. Keypad and Display

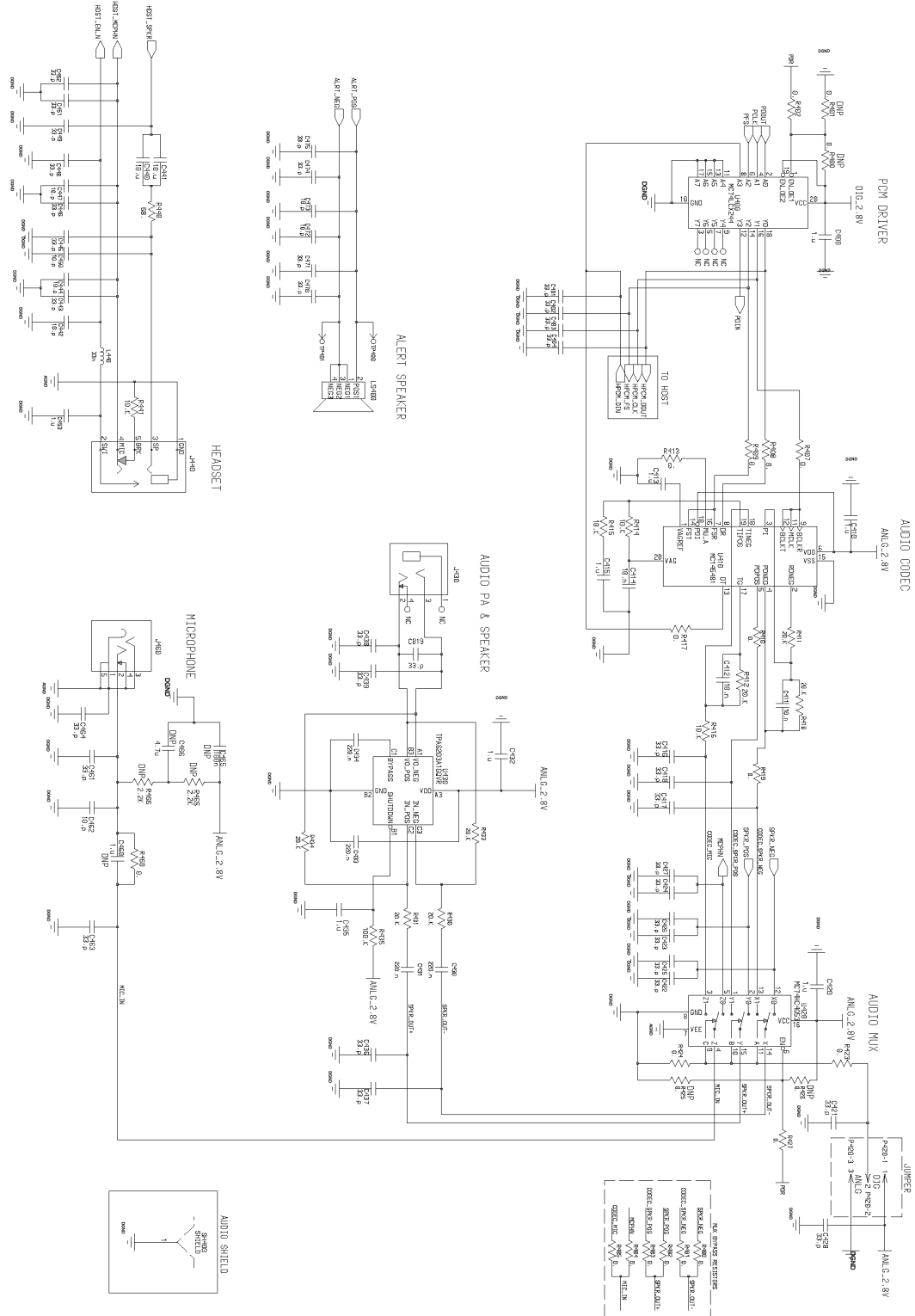


Figure 28. Audio Interface

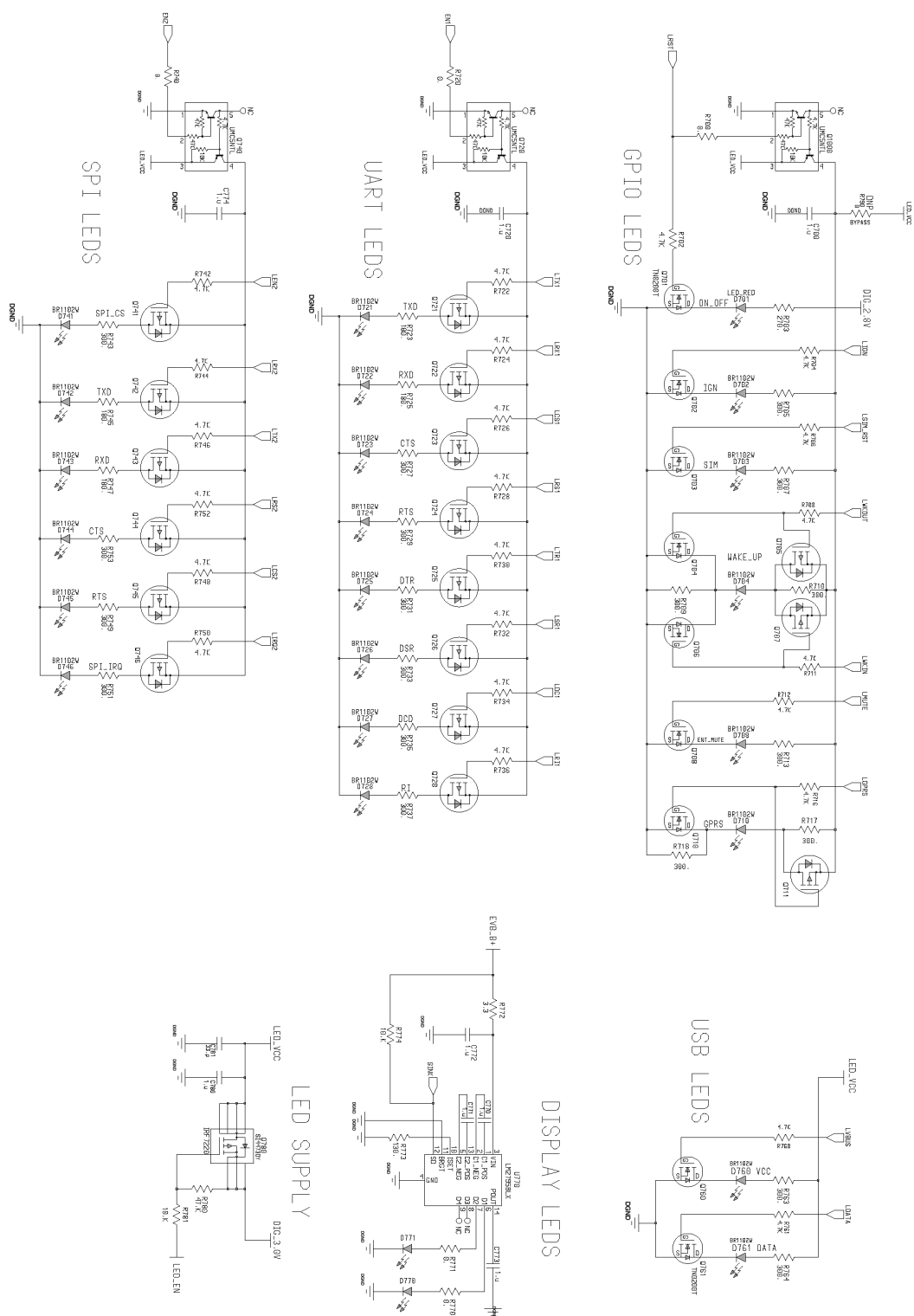


Figure 29. LEDs

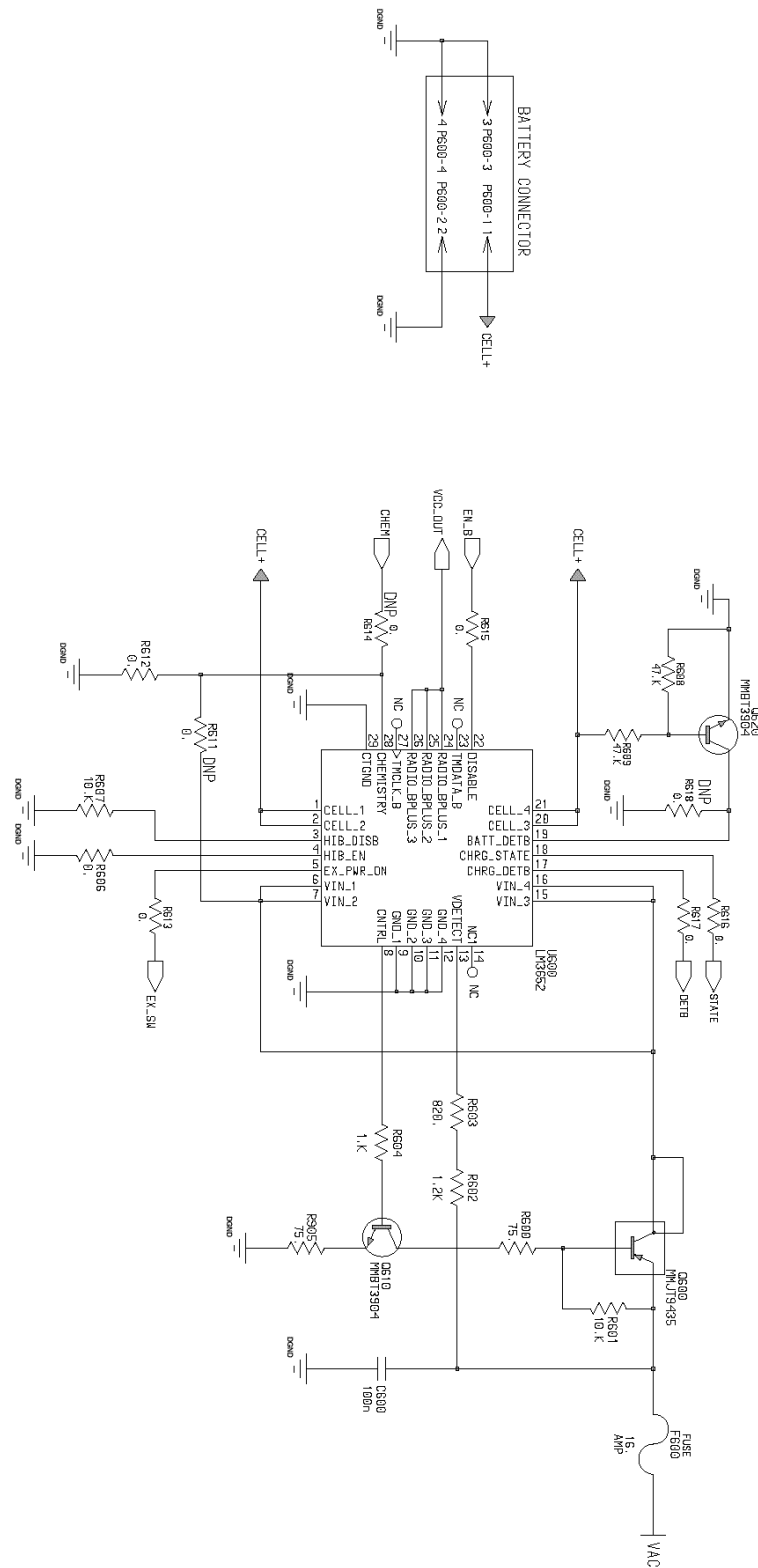


Figure 30. Battery Charger

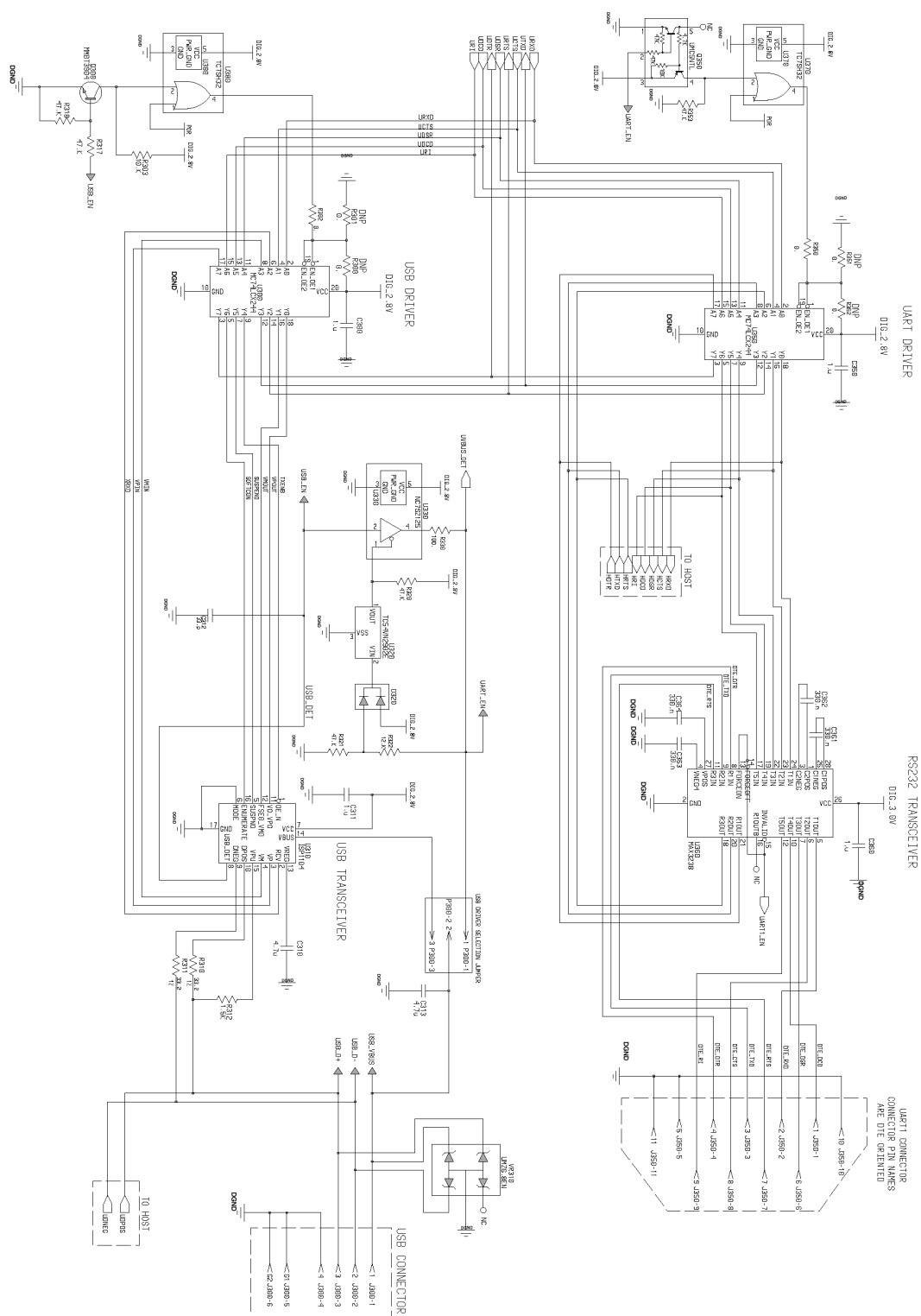


Figure 31. Serial Interface

6.2 DEVELOPER BOARD PLACEMENT

Figure 32 shows the top layout of the Developer Board:

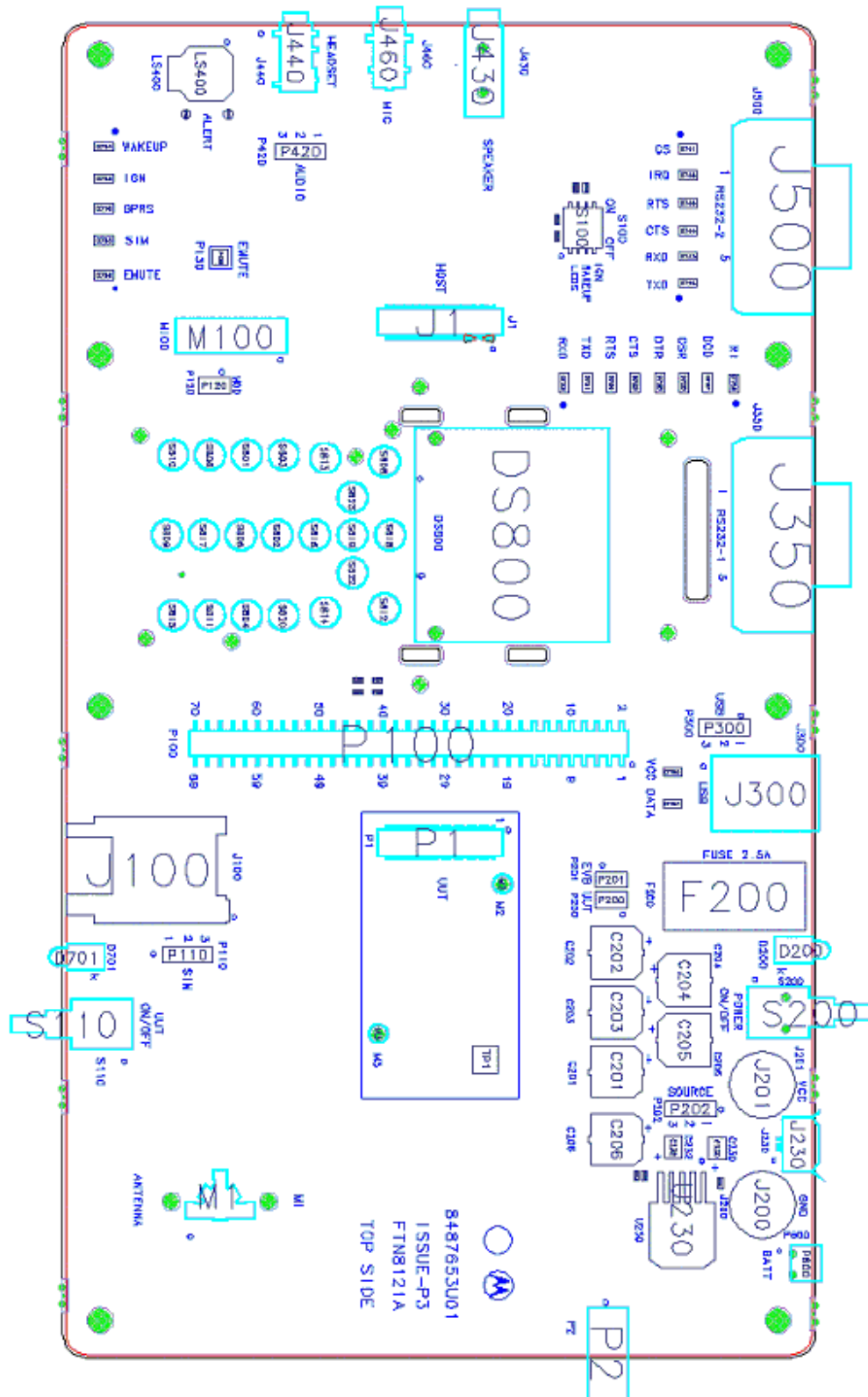


Figure 32. Developer Board Top Layout

Figure 33 shows the bottom layout of the Developer Board:

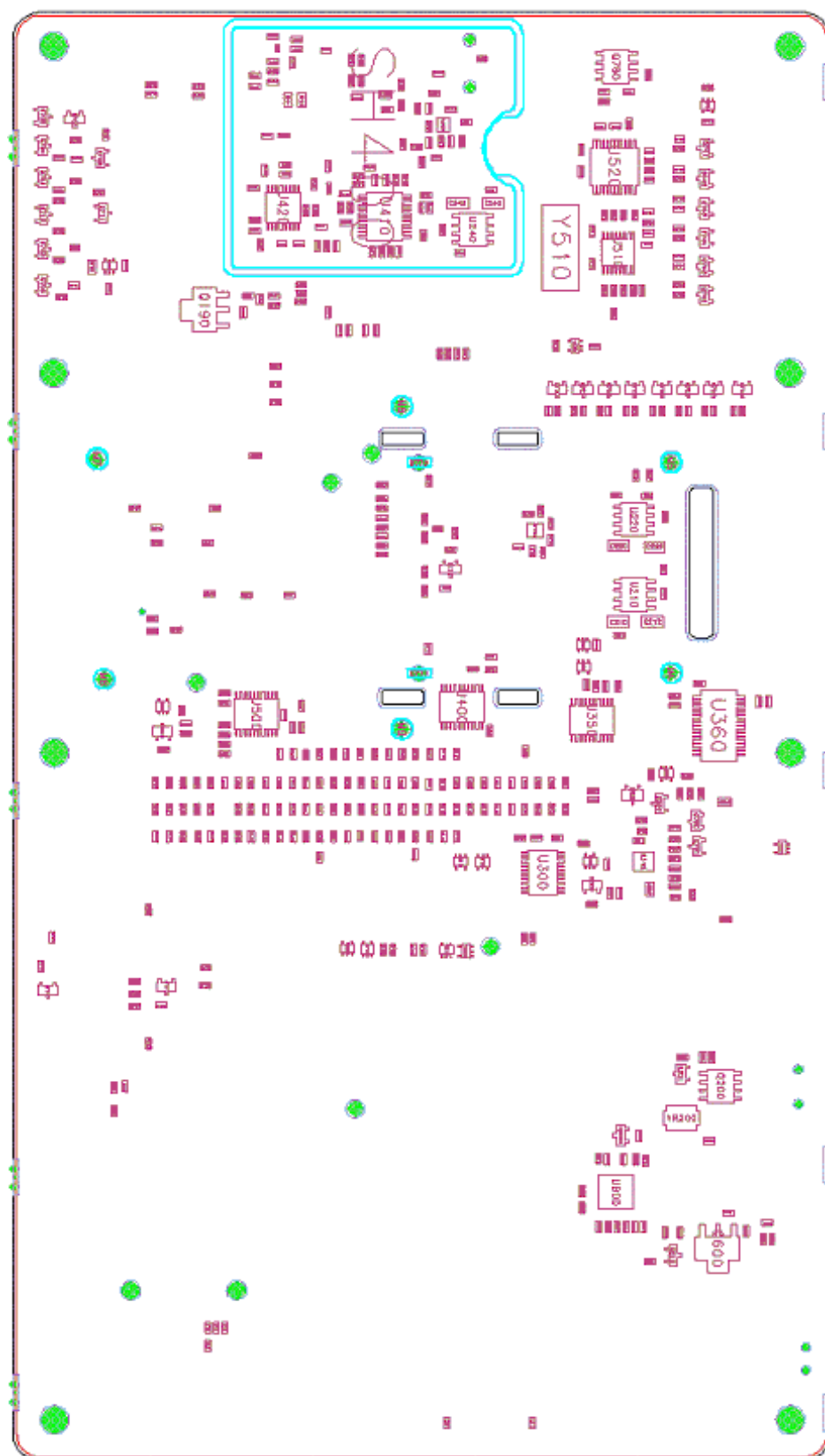


Figure 33. Developer Board Bottom Layout

6.3 DEVELOPER BOARD PARTS LIST

Table 28. Developer Board Parts List

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Resistors		
R440	0662057A21	RES, 68
R600	0662057A22	RES, 75
R330	0662057A25	RES, 100
R773	0662057A28	RES, 130
R723, R725, R745, R747	0662057A31	RES, 180
R703	0662057A35	RES, 270
R705, R707, R709-10, R713, R717-18, R727, R729, R731, R733, R735, R737, R743, R749, R751, R753, R763, R764	0662057A36	RES, 300
R203	0662057A39	RES, 390
R603	0662057A47	RES, 820
R604	0662057A49	RES, 1K
R602	0662057A51	RES, 1.2K
R312	0662057A53	RES, 1.5K
R465-66	0662057A57	RES, 2.2K
R201-2, R702, R704, R706, R708, R711-12, R716, R722, R724, R726, R728, R730, R732, R734, R736, R742, R744, R746, R748, R750, R752, R760-61, R800	0662057A65	RES, 4.7K
R179, R197, R200, R303, R414-16, R441, R508-9, R525, R601, R607, R774, R781	0662057A73	RES, 10K
R230-32, R322	0662057A75	RES, 12K

Table 28. Developer Board Parts List (Continued)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R411-12, R418	0662057A80	RES, 20 K
R177-78, R191-92, R196, R198, R317-18, R320-21, R353, R507, R608-9, R780	0662057A89	RES, 47 K
R435	0662057A97	RES, 100 K
R1, R10-11, R15-16, R107, R116-144, R146, R148-49, R151-53, R155, R157, R159, R170, R172-76, R181-190, R300-302, R350-352, R400-402, R407-410, R413, R417, R419, R423-27, R460, R480-85, R500-503, R506, R510-524, R594-97, R606, R611-618, R700, R720, R740, R770-771, R801-805	0662057B47	RES, 0
R790	0662057C01	RES, 0
R430-31, R433-34	0662057P20	RES, 20K
R221	0662057P95	RES, 100K
R234	0662057P96	RES, 130K
R211, R220, R241	0662057P97	RES, 150K
R210, R240	0662057P99	RES, 200K
R233	0662057T17	RES, 301K
R310-11	0662057T43	RES, 33.2
R772	0662057W13	RES, 3.3

Table 28. Developer Board Parts List (Continued)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Fuses		
F200	0904923K01	FUSE
F600	6586221J04	FUSE
Connectors		
J430	0909032K01	CONN_J
J460	0909399T09	CONN_J
J350, J500	0909672B03	CONN_J
P2	0909908P02	CONN_J
J1	0987547V01	CONN_J
J300	0987583U01	CONN_J
J440	0987837L02	CONN_J
J230	0989601K01	CONN_J
P600	2886290J07	CONN_P
P100	2886397J02	CONN_P
P1	2887548V01	CONN_P
J201	2987604U01	CONN_J
J200	2987604U02	CONN_J
Jumpers		
P130	2880001R01	CONN_P
P120, P200-201	2880001R02	CONN_P
P110, P202, P300, P420	2880001R03	CONN_P
Capacitors		
C1, C2, C3, C4	2113740F01	CAP, 0.5p
C5	2113740F19	CAP, 4.7p
C207, C215, C217, C234	2113740F25	CAP, 8.2p
C442, C444, C447, C450, C462, C472-473	2113740F27	CAP, 10p

Table 28. Developer Board Parts List (Continued)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C100, C102-106, C108-115, C130, C137, C143, C147-151, C153-160, C171, C191-192, C211, C221, C241, C312, C401-404, C416-418, C421-428, C436-439, C443, C445-446, C448-449, C451-2, C461, C463-4, C470-471, C474-475, C502-510, C781, C810-819	2113740F39	CAP, 33p
C125, C128, C131, C134, C208, C216, C218, C231, C511-12	2113740F41	CAP, 39p
C411-412, C414	2113741F49	CAP, 10n
C101, C107, C116-124, C126-127, C129, C132-133, C135-136, C138-142, C144-146, C152, C465, C600	2113743E20	CAP, 100n
C430-431, C433-434	2113743K16	CAP, 220n
C361-364, C521-524	2113743K17	CAP, 330n
C310, C313, C466	2113928C04	CAP, 4.7u
C440-441	2113928C12	CAP, 10u

Table 28. Developer Board Parts List (Continued)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C170, C172-173, C180, C190, C200, C233, C300, C311, C350, C360, C400, C410, C413, C415, C420, C432, C435, C453, C460, C500, C513, C520, C700, C720, C770-774, C780, C800-801	2113928P04	CAP, 1u
C230, C232	2311049A57	CAPP, 10u
C210, C212, C220, C222, C240, C242	2311049A72	CAPP, 10u
C201-206	2387572V01	CAPP, 1000u
Inductors		
L440	2409154M42	IDCTR, 33n
Shields		
SH400	2604044K01	SHIELD
Contacts		
M1	3903920K01	CONTACT
Switches		
S200	4008241G06	SWITCH_ET01
S110	4008242G05	SWITCH
J100	4009060S03	SWITCH_CONTACT_BLOCK
S100	4080564C02	SWITCH
Spacers		
M2, M3, M4, M5, M6, M7, M8, M9	4302809C15	SPACER
LEDs		
D702-704, D708, D710, D721-8, D741-746, D760-761	4805729G44	BR1102W
D770-771	4870370A25	CL-260S-WA
D200, D701	4880304L02	LED_RED

Table 28. Developer Board Parts List (Continued)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Transistors		
Q701-704, Q706, Q708, Q710, Q760-761	4809579E16	TN0200T
Q705, Q707, Q711, Q721-728, Q741-746	4809579E18	TP0101T
Q200, Q780	4809807C31	IRF7220
Q350, Q720, Q740, Q1000	4809939C05	UMC5NTL
Q110, Q300, Q500, Q610, Q620, U771	4813824A10	MMBT3904
Q201	4813824A17	MMBT3906
Q600	4813824B11	MMJT9435
Q190	4813824B13	MMJT9410T1
Diodes		
VR200	4813831A14	SMB5918
D320	4813833C02	MMBD6100
VR100-105, VR310	4886182U05	UMZ6.8EN
Integrated Circuits		
U510	5102870C15	MAX3100EEE
U201, U220, U240	5104187K10	MAX604ESA
U230	5104187K89	MIC29302BU
U370, U380, U530	5105492X05	TC7SH32
U520	5108428S67	MAX3223EAP
U330	5109522E53	NC7SZ125
U360	5109781E76	MAX3238
U320	5109817F26	TC54VN2902E
U420	5113805B39	MC74HC4053
U410	5113811A56	MC145481
U300, U350, U400, U500	5113837A07	MC74LCX244
U430	5186214J87	TPA6203A1GQVR
U600	5187970L09	LM3652
U310	5187970L15	ISP1104
U770	5187970L20	LM2795BLX

Table 28. Developer Board Parts List (Continued)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
General		
M100	5987772L02	MOTOR
Y510	4884450T02	XTAL3_6864MHZ
LS400	5087951K01	SPKR

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